SEPTEMBER 1970

Portable terminals: you can take it with you when you go

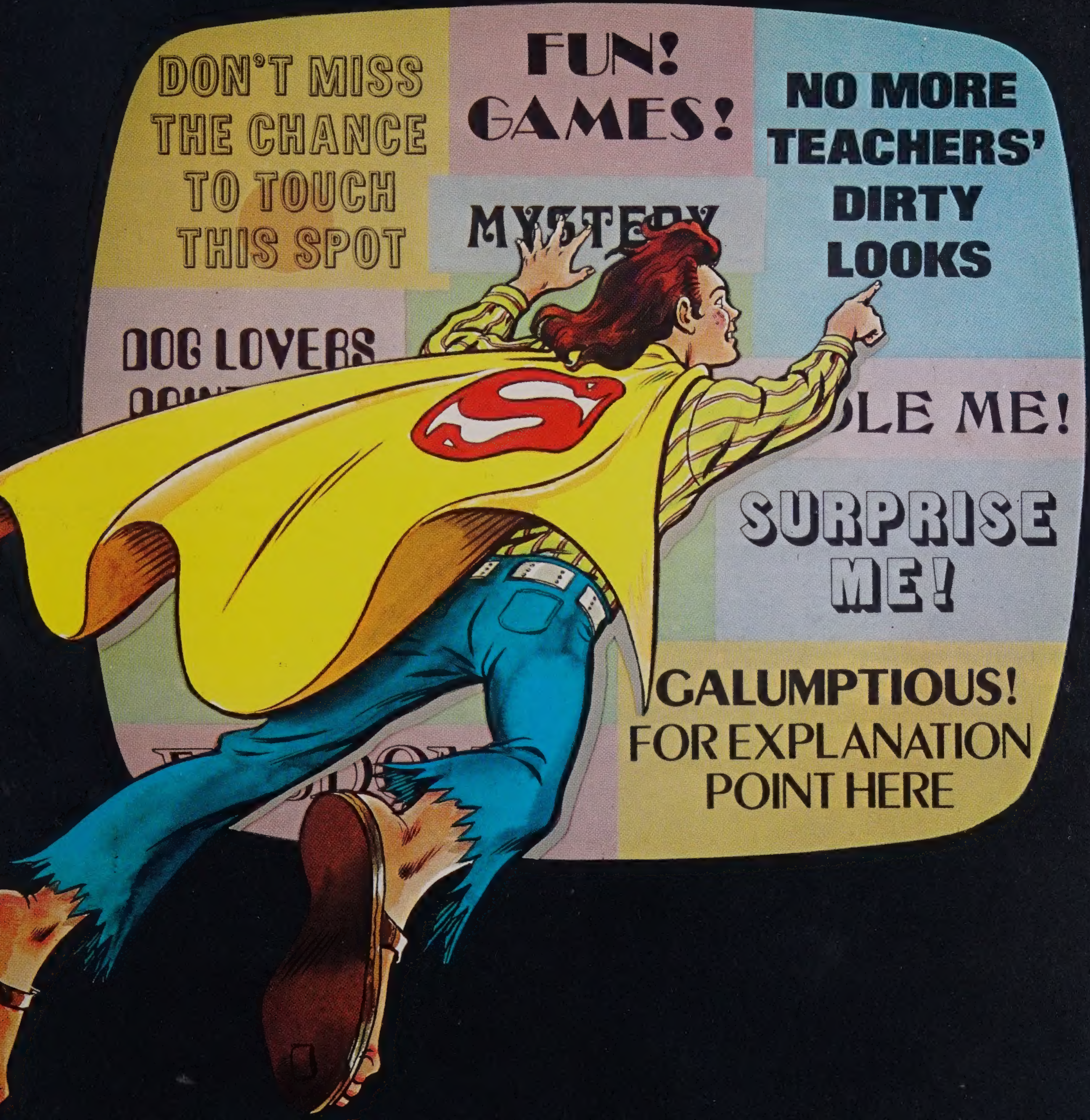
Be mean about management reporting

Minis speed assembly on the factory floor

Computer Decisions

A HAYDEN PUBLICATION INFORMATION SYSTEMS AUTOMATED PROCESSING PROBLEM SOLVING

SUPERSTUDENT enters the world beyond the CRT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GRAPHIC RECORDERS

11921

INFORMATION RETRIEVAL NUMBER 1

7200A GRAPHIC PLOTTER
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PLOT
IMPROPER FORMAT
PEN DOWN
LOWER LEFT
UPPER RIGHT
GRAPH LIMITS

Turn the page for more that's new in Computers from HP

Computer Decisions

PERSPECTIVE

63 **Printout:**
Bring us all together

DEPARTMENTS

2 Newsdata
4 Letters
60 **Voice of the User:**
Self-help training can stem the people crisis
62 Advertiser's Index
64 **Editorial**
Will the computer help us adapt?

NEW DEVELOPMENTS

41 **Spotlight**
Trillion-bit laser memory
42 **Systems**
Small multiprogramming system
44 **Peripherals**
Multi-media terminal
50 **Accessories**
Certifier for disk packs
51 **Software**
Cross assembler package
52 **Services**
Automatic documenter

FEATURES

8 Portable terminals: you can take it with you when you go

Whether you want printed copy, crt display, or voice response, portable terminals give you computer power in a briefcase. Included is a critique of each type of terminal along with a survey of those presently available.
Richard M. Laska, Computer Decisions.

16 No more teachers' dirty looks

Teaching by computer does not make the process scientific. In fact, the computer may prove as much of a block as a teacher. The important point is for the student to become involved so that our children may develop the minds we should have had.
Theodor H. Nelson, The Nelson Organization.

28 Be mean about management reporting

Rather than deluging the hapless manager with reams of computer printout, an information system should only provide reports when situations exceed certain limits. These 'exception' reports can be derived from control charts like those used for quality control.
Norbert L. Enrick, Kent State University.

34 Minicomputers speed automation on the factory floor

The ubiquitous minicomputer has found its way onto the assembly line where it is being used for the control of fabricating machinery. Flexibility and decreased costs can result from using minis rather than the conventional hard-wired controller.
Stephen J. Fryer, General Automation, Inc.

Maxi to midi: new look for COMPUTER DECISIONS

With this issue, COMPUTER DECISIONS becomes a standard-size magazine, in response to the requests of many readers. The editors would like to know your views on the new size, format and editorial content, so why not take a couple of minutes, after reading the magazine, to fill out the postage-paid Reader Reaction Card inserted at the top of this page?

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Now there's a better way.

Our new DOS brings batch processing costs down to $765 a month.

If you've been hanging on to old-fashioned ways because you thought a computer was too expensive, think again. Our new Disc Operating System brings the cost of computation and general purpose processing right down to where your budget lives.

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Anyone who can poke a typewriter key or pencil-mark a card can use our DOS. Because the assembly (or compilation), loading and execution of your programs are under the control of a teleprinter keyboard or batch input device.

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DIGITAL COMPUTERS

INFORMATION RETRIEVAL NUMBER 2

Newsdata

Computer expert named Presidential Advisor

Dr. E. E. David, Jr., an expert on computers and communications, has been appointed Science Advisor to President Nixon. Previously, Dr. David was executive director of communications systems research at Bell Telephone Laboratories, Murray Hill, N.J. Dr. David is also a COMPUTER DECISIONS author (see 'Soviet Computing,' March 1970).

Dr. David is taking up his role at a time when the scientific community is protesting strongly about budget cuts for research and development. It is not known whether Dr. David might play a stronger part in this issue than his predecessor, Dr. Lee A. DuBridge. Dr. DuBridge, 68, resigned because he "had a horror of staying in any job beyond a reasonable retirement age."

Suit against IBM settled out-of-court for $1.4M

Applied Data Research Corporation, Princeton, N. J., and IBM have announced an out-of-court agreement on ADR's anti-trust suit involving one of its proprietary software packages. Under the terms of the agreement, ADR will dismiss its pending suit against IBM and will release the company from any claims; IBM in turn will reimburse Applied Data Research $1.4 million, for certain costs incurred in connection with the suit.

At the same time, it was announced that the two companies are studying a proposal by which Applied Data Research would supply IBM with its Autoflow software package for $600,000 payable over a three-year period. "This however, is not part of our settlement with IBM," stated John R. Bennett, president of ADR, adding that "we are quite satisfied with the settlement with IBM, and we now have a nice business arrangement going."

Viatron lays off 135; gets $250,000 order

Troubled Viatron Computer Systems Corp., Bedford, Mass., announced that 135 more employees had been laid off, leaving a total of 365 still on the payroll as opposed to close to 1,000 last May 1. At the same time Charles Morrill, director of corporate affairs, stated that the company had received a $250,000 order for its System 21 data entry equipment from an unnamed utility.

Morrill noted that the lay-offs were an "across-the-board lay-off, and were designed to reduce operating expenses."

Earlier he flatly denied rumors that the company was in the process of discontinuing all hardware manufacturing and concentrating solely on the production of MOS circuitry.

Morrill also noted that Viatron's OCR line announced at SJCC would not be available for delivery in September as announced.

UK imports of edp gear to hit $650m by 1975

Imports of computers and related equipment to the United Kingdom are expected to rise from $166 million in 1970 to $650 million by 1975 according to a study recently published by the US Department of Commerce.

The study predicts an excellent market in the UK for small and large machines although not for medium-scale systems, mainly because of the competition from the local manufacturer, International Computers Limited. Peripheral imports are likely to show the greatest growth, says the report, particularly in the area of data transmission. The study is not quite so optimistic about software packages, pointing out that, even with the upcoming decimalization of British currency, there are still considerable differences in accounting procedures.

Copies of the report, Electronic Data Processing—United Kingdom IMIS 70-214) are available from the US Department of Commerce, Washington, D. C. 20230, (10¢).

Another committee for computers in Congress

Late this month the House is expected to begin wrangling over a proposal to create a Joint Committee on Data Processing to oversee computer use on Capitol Hill.

The proposal is included in Title 3 of the Legislative Reorganization Act, which the House began debating in mid-July. The House Rules Committee, which reported the bill and strongly endorsed the Data Processing Committee plan, said the House would resume debate on the entire bill immediately after its recess ends September 15, taking up Title 2. The committee spokesman expected the Title 2 debate to move quickly and the data processing portion to come about a week later. Hill leaders expect House approval of the Data Processing Committee although no head-count has been undertaken.

Money for minis

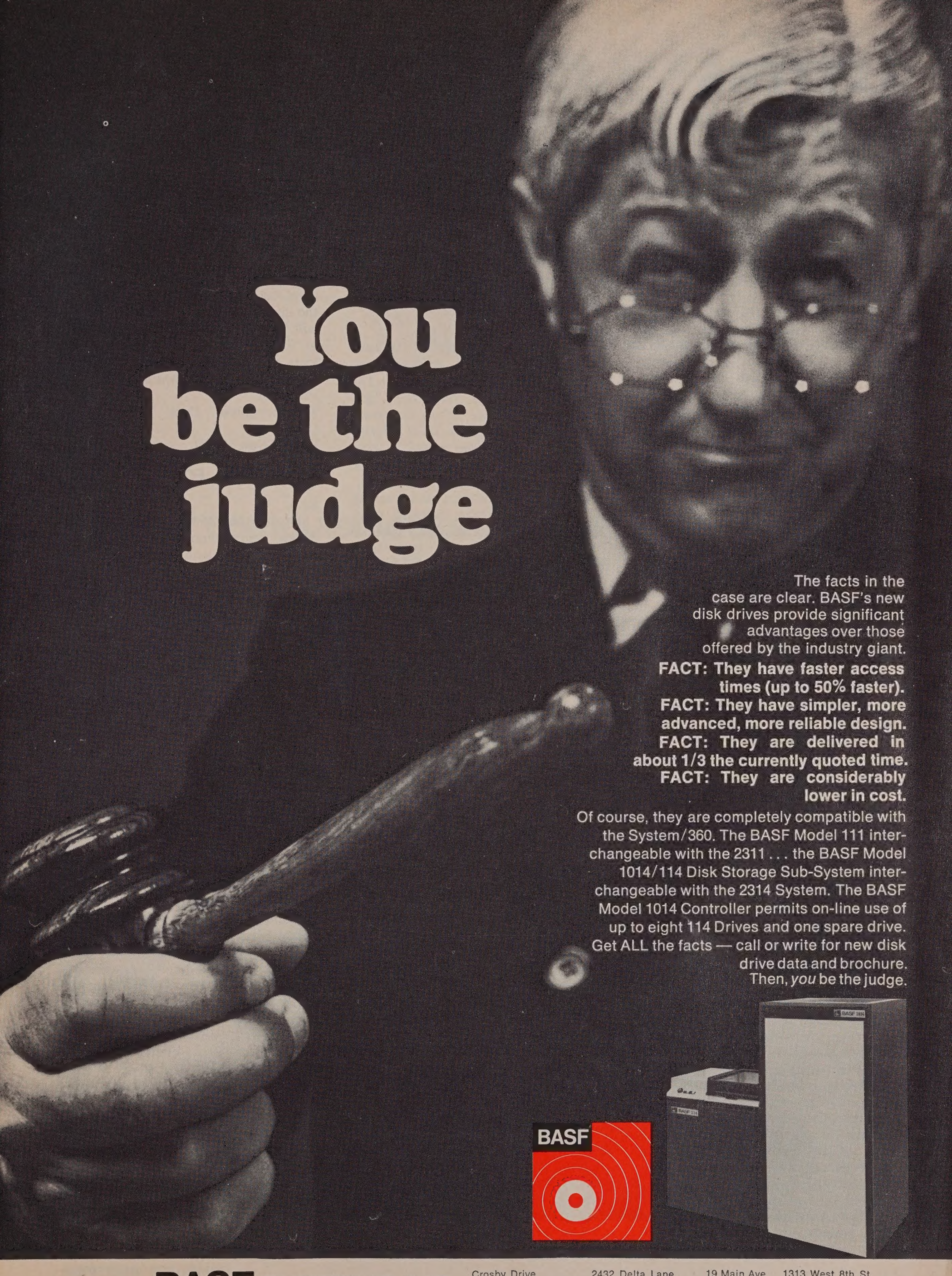
Ten colleges have received grants from the National Science Foundation to evaluate the educational impact of mini-computers. Grants totalling $398,400 were awarded and the participating schools are contributing about $723,000 to the three-year experiment.

Each school will shop for its own computer among general purpose systems costing $12,000-$75,000. The schools, widely distributed geographically and differing in educational emphasis, share a problem common to many colleges—the need for computing facilities to permit academic instruction in computer use.

We hear . . .

. . . that a special investigating subcommittee of the House Armed Services Committee is secretly probing worldwide defense communications of all services. The panel is composed of Rep. Robert H. Mollohan of West Virginia and Rep. Durwood G. Hall of Missouri.

. . . the Bell System is to issue a booklet giving detailed specifications on the telephone network. Should be a great help to many users and to companies designing attachments to the telephone system. . . .



The facts in the case are clear. BASF's new disk drives provide significant advantages over those offered by the industry giant.

FACT: They have faster access times (up to 50% faster).
FACT: They have simpler, more advanced, more reliable design.
FACT: They are delivered in about 1/3 the currently quoted time.
FACT: They are considerably lower in cost.

Of course, they are completely compatible with the System/360. The BASF Model 111 interchangeable with the 2311 . . . the BASF Model 1014/114 Disk Storage Sub-System interchangeable with the 2314 System. The BASF Model 1014 Controller permits on-line use of up to eight 114 Drives and one spare drive. Get ALL the facts — call or write for new disk drive data and brochure. Then, *you* be the judge.

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INFORMATION RETRIEVAL NUMBER 3

LETTERS

Beat this, PL/I-haters

Lois Frampton's article, "How does PL/1 compare with its forebears?" (May) was excellent. The responding letters (July) show for the most part only that their writers did not read Mrs. Frampton's article carefully, or that they simply bear strong grudges against anything connected with IBM.

There is one feature of PL/1 which I am sorry Mrs. Frampton did not mention in her article. That is the preprocessor stage. It is a language feature in which the compiler edits the text of the source program immediately prior to compilation (i.e., the full source text is scanned and edited as required, and then the edited text is compiled.) This greatly enhances the power of the language. One might write a program directly in French (for example, using FIN wherever an Englishman would write END) and still make it perfectly acceptable to the compiler by including the proper preprocessor statements to accomplish translation. (The single instruction: % FIN='END'; would account for all occurrences of FIN in our example, after having declared FIN to be a preprocessor variable.) As another example, one might write a very generalized application program with many many features, each of which is used on only relatively few actual program executions. In other languages this would, most likely, be a very inefficient program when executed. But the preprocessor stage of PL/1 can be utilized to tailor the program specifically to the exact requirements of a given run by deleting unused portions of text, translating other portions and inserting new values of variables, and expanding or adding new text. The compiled program can then be a very efficient one suited exactly to the requirements of the particular execution.

As a challenge to all the pessimists, I'll make the following offer. I'll pay $100 personally to anyone who can duplicate or surpass in any other language the features I have been able to build into a time-sharing data retrieval and reporting system implemented with PL/1. It speaks English with its user, provides error diagnostics and recovery at the terminal during execution, can produce any one of over a thousand different management reports given only the desired report number, allows output format changes during execution, will produce a given report in units, dollars, pounds, lire, francs, or any other currency on command, automatically justifies column headings, rounds and keeps track of its own data files, among other things. I'll be glad to send a full write-up to anyone who requests it. Any takers?

Joseph W. Schmitt

Glen Ellyn, Ill.

Circle information retrieval number 118 for Mr. Schmitt's write-up.

ACM-DPMA merger?

Sir:

Your editorial in the 1970 June issue is timely, and I agree enthusiastically with your arguments. *(The editorial suggested that the "get-things-done" people in the computer field should coordinate their efforts.)* However, one seldom writes a letter to the editor to praise him unless he has a "but", and I do.

By logical inference, you are saying that I belong to the "slightly more commercially oriented group" *(within the ACM).* You then say that "even this group does not feel that people like (DPMA) are really at their level."

This is not consistent, for I am a member of DPMA as well as of ACM. I spoke to the recent Seattle meeting of DPMA (at the expense of much time out from the ACM 70 activities to write my paper), and exhorted them to persuade Calvin Elliott to name a formal representative to the National Computer Year Planning.

Furthermore, as a member of the ACM Council I was the first to propose a formal merger with the DPMA, somewhere about 1963.

R. W. Bemer

Manager, Systems and Software Integration
General Electric Co.
Phoenix, Ariz.

Editor's reply: A few more Bob Bemers and the industry would really get on the track! What about that DPMA - ACM merger? Some of our member-readers may have some pertinent comments. They will be forwarded to the officials of the respective societies.

Standards for shipping data

Sir:

Congratulations on the Voice of the User on standards by Thomas B. Steel in the July issue. I should like to bring to your attention the national programs for data uniformity that are being carried out by the shipper/carrier/banking and government community through the Transportation Data Coordinating Committee.

The Transportation Data Coordinating Committee, 1101 17th Street, NW., Washington, D.C., has been established as a non-profit organization of shippers, rail-motor-ocean-air-barge carriers, forwarders and banks to save the transportation industry which has become inundated by non-compatible, costly and delaying paperwork. Seven major task forces of industry and government are deeply involved in developing and fostering the codes, formats and systems which will permit external communication of data by computer throughout this vital sector of the nation's economy.

Edward A. Gilbert

President
Transportation Data Coordinating Committee,
Washington, D.C.

Support the FCC

Sir:

During the 1960's, the computer industry and communications moved toward a confluence to create a new industry — computer/communications. But the innovation of the computer industry has not been matched by innovation in common carrier services.

The common carriers have continued to concentrate their efforts toward providing better service in their areas of communications monopoly—telephone and telegraph services—and have failed to meet computer users' needs. As a result, new communications companies have sought to provide new, specialized common carrier services. The FCC has recommended the entry of specialized common carriers and stated that competition will give computer users lower communications costs, will encourage specialized services required for data transmission, and will create growth of communications-oriented computer applications.

In issuing this landmark staff position, the FCC asked for comments by all interested parties. These comments can simply be letters from communications and computer professionals expressing their views on the issue of competition in communications. Why not write a letter to Ben E. Waple, Secretary, Federal Communications Commission, Washington, D. C. 20554. State that you support the Common Carrier Bureau position on specialized common carriers.

Calvin C. Morrell

Manager communications and data collection
Continental Can Co., Inc.
New York, N.Y.

You've gone computer. You've given it a good try. Now you're disenchanted. You're unhappy about the costs/results ratio.

You've also got lots of company.

If yours is a typical situation, it's the most common problem in data processing—and the problem is *not* the computer.

The bind comes with the excessively high cost of data capture and control: input preparation. And perhaps worst of all, those high costs discourage the implementation of many useful programs. So full use of the computer isn't even being made. (It's like keeping a fine car in the garage because the fuel is too expensive.)

But the gathering of data for computer processing need not be costly or complicated.

With the Addo-X system, data is prepared automatically, in computer-acceptable form, *as a by-product* of normal accounting, reporting, and record-keeping operations. Keypunching is eliminated (count *those* savings for openers). So are error-correction and data-verification costs.

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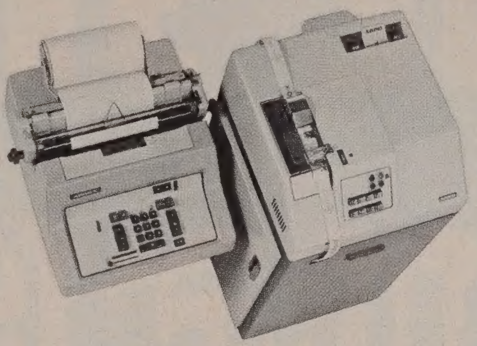

And no errors—because this is a *programmable* method. Procedural errors are impossible; they're actually caught before they happen. (If the operator makes a mistake in the assigned procedure the machine simply locks. No entry, thus no error.)

Many companies of every size are profiting right now from the economical Addo-X system. All it takes is a brief review to see how it can serve you too. And all that takes is your call or note now.

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INFORMATION RETRIEVAL NUMBER 4

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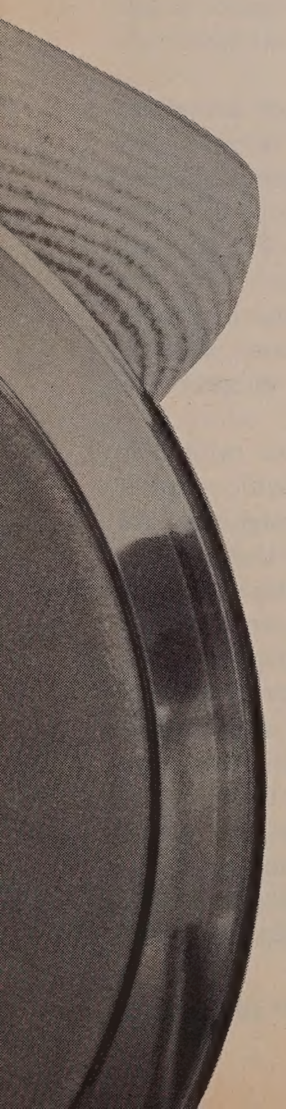


When the name on a disk pack is "Scotch" Brand, it comes from the world's most experienced producer of magnetic computer products.

It's a product of the pioneers who gave the EDP industry its first computer tape.

It's made by the same people who have made virtually every major technological breakthrough in magnetic media.

You can expect "Scotch" Brand Disk Packs today to be unsurpassed in reliability and performance. And when the next advance comes in disk packs, you can expect it to come from 3M.

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M COMPANY.

3M COMPANY

The barrier breakers.

INFORMATION RETRIEVAL NUMBER 5

Portable terminals: you can take it with you when you go

by Richard M. Laska
Assistant Editor

With their cables, plugs, printers and storage units, computers are anything but portable. But computer power is. Along with the growth of timesharing has grown the need to be able to communicate with the computer from remote and varying locations. Portable terminals are now available which offer the user a data entry keyboard plus all three popular means of computer output: printed page, crt display, and voice response. All the user needs is a telephone and, in most cases, an electrical outlet.

Portable terminals can do almost anything that a small stationary terminal can do (except accurate plotting), but they are slower due to the limited capacity of the telephone lines through which the data is transmitted. Originally developed for use by salesmen of timesharing services, portable terminals were needed to demonstrate services to prospective customers. The first terminals were basically teletypewriters weighing over 60 pounds and requiring two suitcases to carry. Despite these handicaps, robust young programmers took to lugging these terminals home to work out the day's programming problems.

Fortunately for the user, portable terminals no longer require herculean strength to carry about. The teminals covered by this survey range in weight from five pounds for a voice response terminal to less than 50 pounds for a heavy portable printer. For the purpose of this article, only those units which are complete within themselves are considered "portable terminals." For example, some "portable video terminals" require a standard television set for display, and tv sets are not always available where the user wants a portable terminal. Strip printers are excluded because of their severely limited flexibility.

How much is portability worth to you?

The first question to answer when considering the introduction of portable terminals is: When does it make economic sense to provide personnel with these units? There are five basic conditions which can be used to justify portability:

- Interaction with the computer is to be performed outside a permanent location.
- The nature of the application does not require high volume or high speed input or output.
- A high value is placed upon interacting with the computer.
- A short turn-around time between the input of data and the reception of the response is critical.
- The processed output carries a high value.

The most obvious area of application which might satisfy these conditions is a company's sales force. Salesmen can use their portable terminals to check inventory, record orders, obtain complex fee schedules (such as in insurance), and, at the end of the day, submit their expense reports. Such instant, in-the-field interaction not only provides the sales force with a much more dynamic sales tool, it also gives management up-to-the-minute reports on sales progress and more effective control over its salespeople.

For most applications, portable terminals are more expensive than stationary ones. However, in some situations, portable units can actually save money. Where access to a computer is required from many different locations within a company, a multitude of fixed terminals would be economically impractical. For example, through a portable terminal a doctor in a hospital could query a patient's medical record without needing a terminal in every room. Only a telephone is needed.

Another area where portable terminals might be useful on a more limited basis is to provide greater flexibility for a company's engineering, designing, and programming staff. A portable terminal for these highly skilled and expensive personnel would allow them to "take their work home" should they become deeply immersed in a project or run too close to a deadline. The intangible benefits of such a capability are extensive in terms of employee creativity and satisfaction. Also, the second-and especially third-shift computer time is much less expensive than first-shift time.

Once the decision has been made to employ portable terminals, the next question to be resolved is the matter of hardware: what kind of portable terminals best fit a company's applications? Basically there are

Whether you want printed copy, crt display, or voice response, portable terminals offer you computer power in a briefcase.

three types of terminals — page printers, voice response units and cathode ray tube (crt) displays.

Terminals that print hard copy

For those applications requiring hard copy, portable page printers are available which print out data on a roll of paper. These printers, descendants of the Model 33 Teletypewriter and therefore Teletype-compatible, are the most common portables in use today. Page printers use two different methods to produce characters: impact and thermal. Impact printers produce multiple copies and use ordinary paper. Examples of this type of portable printer are those manufactured by Tracor Data Systems, Inc. and the Stelma Division of Data Products Corp.

Electrostatic or thermal printers require special paper which costs about three times as much as standard paper. These printers do not produce multiple copies. Electrostatic or thermal printers such as those manufactured by Computer Transceiver Systems and Computer Devices are generally quieter than impact printers, faster — (15 to 30 characters per second versus 10 to 15 for impact printers) — and have less moving parts, thus subject to less maintenance problems. The weight of portable printers varies from 20 to 50 pounds. Acoustic couplers are built into most printers; in some instances the acoustic coupler is separate. A few manufacturers such as DataTerm and Electronic Information Systems, Inc. are modifying ordinary electric typewriters and supplying acoustic couplers built into the carrying case. The result is a heavier but cheaper portable terminal — approximately $1,000 versus $2,000 to $3,000 for the high quality impact printers.

One criterion for choosing an impact over a nonimpact printer is the need for multiple copies. While it is generally not practical to print forms on a teleprinter, nevertheless there are occasions when multiple copies are required. For example, where a record of a transaction must be distributed to several people, or where it is necessary to show work completed.

The deciding factor in choosing page printers over either crt displays or voice response units is the need for hard copy. Therefore, the important issue to determine is: when is hard copy necessary?

- When the nature of a transaction is so complicated that reference to hard copy is desirable.
- When a record of a complete transaction is required the first time through because it would be uneconomical to regenerate the output. (This situation arises when the user does not have easy access to the computer).
- When further useful work can be done with the hard copy without additional communication with the computer.
- When it is desirable to leave a copy of the transaction.

However, sometimes hard copy is not as useful as might be expected. For instance, where many corrections have been made on the copy, the user may not want to leave it behind as a record. This problem of "messy copy" is caused by the page printer's limited editing features. Page printers cannot correct mistakes in the copy, but this capability can be programmed into the host computer. If a mistake is made, the user can type a special symbol, which appears in the copy, to inform the computer to delete the error. The user then retypes the correct message.

If the user requires error-free copy, software can be developed which instructs the computer to transmit the entire message, free of errors, when the transaction has been completed correctly. Or, this corrected version can be printed on a high-speed printer at the computer center and then mailed to the user.

Computer software gives the user of portable page printers additional capabilities. Software enables the computer to print out data in orderly columns for pricing schedules or tables. To aid in formatting, software can lay out a form in the computer's memory so that the computer will ask a prescribed set of questions to be answered by the operator. Of course, a penalty is paid in transmission time and software complexity for the computer to ask the questions, obtain the answers, assemble all the data and print out the entire form. The system is controlled by the nonprinting control keys on the page printers. These control keys do not produce visible marks on the copy, so an error in their use can go undetected. Software or clearly designed keyboards can alleviate this problem.

Portable terminals . . .
(continued)

You need more than just a terminal

Besides the printer terminals themselves, other equipment is necessary for a full teleprocessing system. Along with modems and modem interfaces of appropriate speed and data format, a communications interface to the computer is required which must be able to handle a number of phone lines. For instance, a company with 50 salesmen in the field might require the ability to handle three terminals simultaneously. Extra capacity, although expensive, is important to keep the salesmen from encountering too many "busy" signals.

In addition, the teleprocessing system requires software compatible with the portable printers selected. Generally, Teletype software available from the manufacturer will serve this purpose. The company's applications programs also must be developed. Other costs would involve the additional core memory and peripherals. This increase in computer hardware might be as much as double that necessary for a standard batch processing system.

Fact sheet: portable printer terminals

Manufacturer	Model	Weight and Size	Print technique	Print speed (cps)	Character set ASCII	Line length (char.)	Features: ac = acoustic coupler pc = parity check nkc = numeric key cluster pi = peripheral interface	Price and Lease	Information retrieval number
Computer Devices, Inc. 10 Sonar Dr. Woburn, Mass. 01801 (617) 729-7436	1010	25 lb. 18x14x6	impact	10	send - 128 char. receive - 64 char.	80	ac; pc (odd or even)	$2,100	201
	1030	25 lb. 19x14x7	thermal	10,15,30	send - 128 char. receive - 64 char.	80	ac; pc (odd or even or none)	$3,600	202
Computer Transceivers Corp. 317 Rt. 17 Paramus, N.J. 07652 (201) 261-6800	Execuport 300	30 lb. 18x18x6	thermal	10,15,30	96 char.	80	ac; pc; nkc; pi for crt, cassette	$3,800	203
Data Products Corp., Systems Div. 6219 DeSoto Ave. Woodland Hills, Calif. 91364 (213) 887-8446	Porta-Com	30 lb. 18x19x5	impact	10	send - 128 char. receive - 64 char.	80	ac; pc; nkc (13 extra symbols); pi for card punch, crt, mag. tape, etc.	$2,450 $95/month	204
DataTerm, Inc. 1611 Manning Blvd. Levittown, Pa. 19057 (215) 949-1910	Model 35	38 lb. 20x18x8	impact	10,15	96 char.	132	ac; pc (opt.)	$1,800	205
Electronic Information Systems, Inc., 2400 Industrial Lane Broomfield, Colo. 80020 (303) 466-1985	ET-39A	25 lb. 18x13x7	impact	10	64 char. - upper case	72, 102 adjustable	ac (separate unit); pc (send only)	$1,359	206
Mite Corp. 446 Blake St. New Haven, Conn. 06515 (203) 387-2572	Model 123	29 lb. 19x13x7	impact	10,15 (opt.)	64 char.	80	ac; pc; pi (opt.)	$2,000	207
Novar Corp. 2370 Charleston Rd. Mountain View, Calif. 94040 (415) 964-3900	5-41	48 lb. (without case) 22x20x9	impact	15	standard Selectric	130	pc; pi; ac (opt.); nkc (opt.)	$4,050 $99/month	208
Texas Instruments, Inc. P.O. Box 66027 Houston, Texas 77006 (713) 526-1411	Data Terminal	32 - 38 lb. 19x19x7	thermal	10,15,30 40 (opt.)	94 char. or 86 char. PTT/BCD	80	ac (opt.); pc (opt.); pi	$2,565 $111/month	209
Tracor Data Systems, Inc. 6500 Tracor Lane Austin, Texas 78721 (512) 926-7770	1601	34 lb. 21x12x7	impact	10,15	64 char.	80	ac; pc; pi	$2,700	210
Vernitron Corp. 176 Central Ave. Farmingdale, N.Y. 11735 (516) 694-5002	Dataport VI	30 lb. 16x21x7	impact	10	96 char.	72 or 80	ac; pc (even)	$2,850 $93/month	211

The chart above gives the important statistics on some of the popular portable terminals now available. Note that the thermal printers are generally both lighter and faster than the impact printers, but they also tend to be more expensive and do not produce multiple copies of the output.

The crt terminal: swift, silent, mobile

The portable crt terminal has the capabilities of the page printer but does not produce printed output. Unlike a page printer the crt terminal contains a memory for retaining data displayed on a screen. This "refresh" or buffer memory provides a means to locally edit data prior to transmission and to divide the displayed data into specific fields for rapid entry. Because of this editing capability, less extensive software is required at the computer center. While large expensive cathode ray tube terminals have long offered these advantages, it is only within the past few months that they have become available in portable units such as that made by Applied Digital Data Systems.

Local editing can be performed through manipulation of the cursor, horizontal tab and screen erase controls. The user can choose various modes of operation. In the "conversational" mode there is no local editing and the typed character is simultaneously displayed on the screen and sent to the computer. In the "page" mode, the user can edit an entire page before transmitting it. A "message" mode helps edit page sections.

These portable crt terminals are able to display both fixed and variable data simultaneously. Fixed data can appear on the screen written in grey characters (half intensity) while the variable data is written in black. In this way, the computer can cause a blank form to appear on the screen which the user can then fill in. Fixed data cannot be lost since the cursor and erase controls operate only in the areas reserved for the variable data. Furthermore, only the variable data is transmitted, thus saving communication time.

Another feature which saves communication time on a crt terminal is its ability to scan ahead: if the rest of the line or the rest of the screen is blank, the cursor automatically resets itself. The "blanks" are not transmitted to the computer. Portable crt terminals are most useful in situations where:

- The formatting and editing capabilities are desirable.
- Reference to complicated formulae or other data is required to solve an immediate problem.
- Speed and flexibility are important, but hard copy is unnecessary.
- Communication line and computer time are at a premium.

One disadvantage of the portable crt terminal is that, if the user wants to use the crt to replace a teletypewriter, software modifications are required to compensate for the difference in the character length of the displayed line. The crt line contains 32 or 64 characters versus the teleprinter's 72 character line.

Manufacturer	Model	Weight	Dimensions	Characters per line	Lines per display	Data protect	Transmit variable data only	Insert and delete	Price and Lease	Information retrieval number
Applied Digital Data Systems, Inc. 89 Marcus Blvd. Hauppauge, N.Y. 11787 (516) 273-7799	Envoy 600	32 lbs.	22x16x7	32	16	no	no	no	$3,195 $151/month	212
	Envoy 640	32 lbs.	22x16x7	64	16	yes	yes	yes	$3,695 $174/month	213

Voice response: a word with your computer

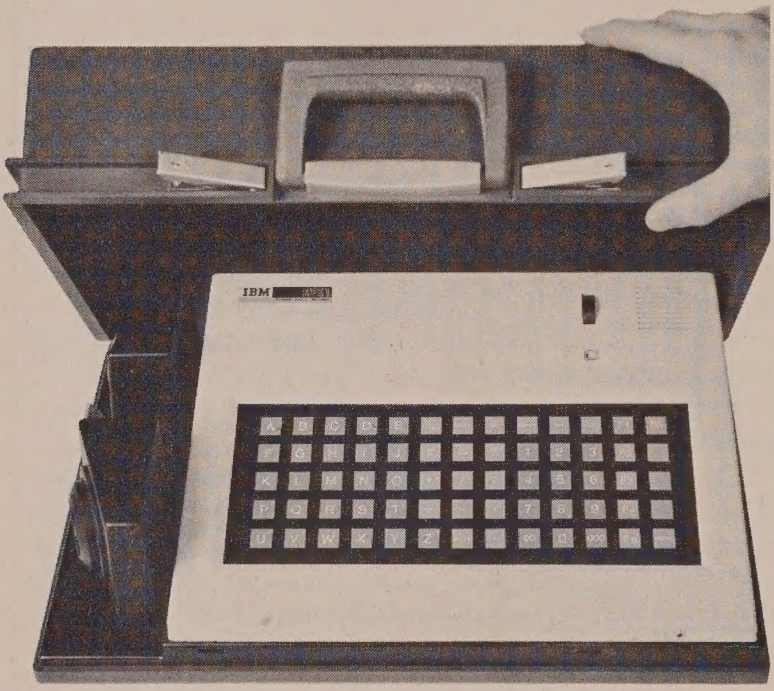
The third class of portable terminals uses voice response for output. In general, these terminals are more suitable for applications where brief and simple replies to remote inquries are required and where computer interaction or hard copy output is not needed. While voice response terminals are relatively new, similar systems have been in existence for some time. For example, in credit verification systems a tone or a beep coming back verifies someone's credit standing.

The simplest voice response system is one which responds to the tones of a Touch-Tone telephone. Here one has three options for terminals; a device for use with the ordinary dial-up telephone; a Touch-Tone telephone; or a terminal with a built-in keyboard and an acoustic coupler.

An example of a device utilizing a dial-up telephone is the Audio Response Terminal manufactured by Metro-Processing Corp. of America. Actually a coupler, this unit weighs under two pounds and is carried around in a small carrying case. It can be attached to the mouthpiece of an ordinary dial telephone in seconds. The user hears the response of the computer through the normal earpiece of the phone, and enters data through a small keyboard exactly like that of a standard Touch-Tone telephone.

While employing either a dial telephone with the acoustic device or a Touch-Tone telephone as input devices is very inexpensive, their very simplicity limits their application. Training to use them must be more intensive than that needed for terminals with keyboards, and operator error rate tends to be high.

The portable terminal with its own keyboard is manufactured by such companies as IBM and Electronic Data Systems. These keyboards vary, containing as many as 60 keys. A significant feature is the identification card reader to prevent unauthorized use of the terminal or the computer. On some terminals, overlays can be placed on the keyboards to help the user perform different applications. The broader array of keys enables the user to generate much more information to the computer than does the use of an ordinary Touch-Tone pad. However, the data set used to receive the data at the computer is more expensive.



When should voice response terminals be chosen over other forms of portable terminals?

- When inquiries and responses are short and uncomplicated. Perhaps the maximum limit for inquiries or responses should be 10 words or codes.
- When a battery-operated portable terminal is mandatory due to lack of ac power.

Stock brokers operating outside their offices could use the voice response terminals for the latest quotation on a stock; a traveling salesman for the status of inventory; or a patrolling officer for the latest information on the status of a suspicious car.

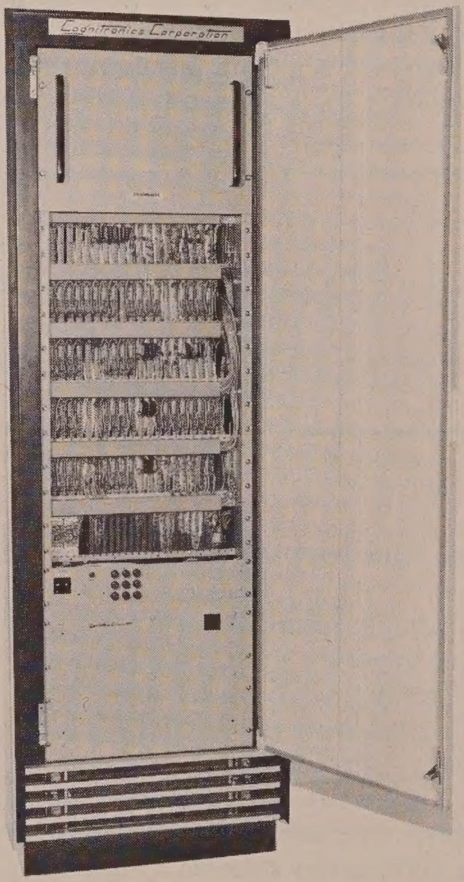
The words and phrases transmitted by a voice response terminal are produced in any of three ways: from magnetic drum (much like a tape recorder), from light modulated on film (like the sound track of a movie), and digitally through various filtering mechanisms. The light-on-film is relatively inexpensive and it is easy to change vocabularies, but the vocabularies are limited. The magnetic drum is reliable, and the digital method offers extended vocabulary with adequate computer disk storage. All have comparable response times.

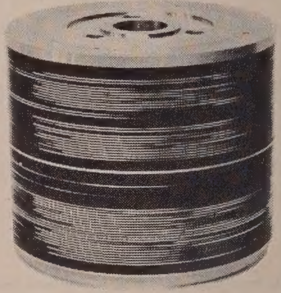
By the very nature of voice response systems, these terminals do not have any editing capabilities such as those of the crt terminals or software-assisted page printers. This fact of itself necessitates limited inquiries to the computer, for there is no way to correct an error in transmission. It has been estimated that the error rate is about one percent per digit.

Thus, it is necessary to protect the operator from errors as much as possible. The use of overlays that fit the keyboard help enormously, as do specially designed keyboards. Systems can also be arranged to read back to the operator the information which he entered. If he listens, he can catch his errors.

An attempt has been made to avoid the high error rate in the design of some portable terminals, where information is entered and stored on digital thumbwheel switches, and on slide switches. After all entries have been made, the data can be proofread for accuracy before it is transmitted to the computer.

A voice response system requires extensive hardware at the stationary computer headquarters. The voice response unit itself, which interfaces to the computer, can range in price from $10,000 to $150,000 depending on the vocabulary size required and the number of telephone lines to be serviced. The terminals are themselves are very inexpensive. When deciding whether to install voice response capability or not, a company with an existing teleprocessing system must consider the expense of mixing configurations by bringing in a voice response system which requires its own software and maintenance. In effect, a company would be paying for two systems by creating a voice response system along with an existing teleprocessing system.





Stationary hardware for voice response systems: A voice response unit (left) and an audio storage device such as a film drum (above) are necessary to analyze inquiries from portable voice response terminals and to produce the desired answer.

Regardless of which mode of interaction the user chooses, he will be adding significant capabilities to his existing computer systems. The near future will invariably bring a truly lightweight, battery powered portable crt terminal with hard copy option. □

Voice response keyboard terminals

Manufacturer	Model	Weight and Size	Power supply and modem at computer	Number of keys	Provide fixed identification code?	Price and Lease	Information retrieval number
Chancellor Industries, Inc. 2416 LTV Tower Dallas, Texas 75201 (214) 741-7283	PRT	5 lb. 9x9x3	ac or battery 401 or 403	16 60 key alphanumeric option	yes, card reader option	$500 (approx.)	214
Computer Utilities N.W. 900 Thomas St. Seattle, Wash. 98109 (206) MU 2-6836	Accutone 100	8 lb. 9x12x3	ac, battery option 403	12	yes, via card reader	$875 $25	215
Computone Systems, Inc. 361 E. Paces Ferry Rd. N.E. Atlanta, Ga. 30305 (404) 261-0070	CT-60	9 lb. 12x18x4	ac or battery 403	60 switches, numeric only	yes, via internal card	$700	216
Computone Systems, Inc. Martinsville Rd. Liberty Corner, N.J. 07938 (201) 647-3200	CT-14	9 lb. 6x13x13	ac, battery option 401 or 403	input via switches 12	yes, card reader optional	$500 $20	217
IBM, Data Processing Div. 112 E. Post Rd. White Plains, N.Y. 10601 (914) 949-1900	2721	10 lb. 16x9x4	ac or battery 401	60	yes, optional	$600 (numeric only) $20	218
Technitrend, Inc. 7300 N. Crescent Blvd. Pennsauken, N.J. 08110 (609) 665-4910	TT 3100	7½ lb. 12x12x6	ac or battery 403	12	yes, card reader optional	$350	219
Vernitron Corp. 176 Central Ave. Farmingdale, N.Y. 11735 (516) 694-5002	VTT-3	15 lb. 18x14x4	ac or battery 401	61	yes internal mag. tape cassette option	$500	220

Stationary voice response hardware

Manufacturer	Computer system used	No. of words and No. of phone lines	Price	Information retrieval number
Burroughs Corp. 6071 Second Ave. Detroit, Mich. 48232 (313) 875-2260	B300, B342, B500 to B6500	189 up to 125	$37,500	221
Cognitronics Corp. 333 Bedford Rd. Mt. Kisco, N.Y. 10549 (914) 666-2941	Interface with most popular systems	10 to 189 2 to 200	$1,039 to $14,000	222
Data Trol, Inc. Kane Industrial Dr. Hudson, Mass. 07749 (617) 562-3422	IBM 1800, IBM 1130	31 to 189 1 to 60	$80,000 (16 lines, 189 words)	223
Honeywell, Inc. Fourth Ave. S. Minneapolis, Minn. 55408 (612) 332-5200	Honeywell series 200	31 to 189 1 to 60	$40,600 to $260,000	224
IBM, Data Processing Div. 112 E. Post Rd. White Plains, N.Y. 10601 (914) 949-1900	System/360 30 to 75	32 to 128 10 to 50	$55,870	225
	System/360 30 to 75	unlimited words 2 to 8	$29,100	226
RCA Corp., Info. Systems Div. Rt. 38, Haddonfield Rd. Cherry Hill, N.J. 08034 (609) 963-8000	Spectra 70 series	31 to 189 10 to 50	$24,250 to $38,800	227
Technitrend, Inc. 7300 N. Crescent Blvd. Pennsauken, N.J. 08110 (609) 665-4910	IBM 360/30 and up	32 to 700 2 to 256	$36,000 and up	228

Choosing the medium for your message:

The three different modes of output employed by portable terminals — printed page, crt display and voice response — are each suited for different applications. The following chart lists some user needs and classifies the output style according to how well it satisfies these needs.

User needs:	Page printer	Crt display	Voice response
Battery operation	3	3	1
Local editing	2	1	3
Silent operation	2	1	2
Hard copy	1	3	3
Lightweight	2	2	1
Input format control	2	1	1
Output format control	2	1	2
Rapid data transmission	1	1	2
High volume input/output	1	1	3
Application versatility	2	1	3
Hardware reliability	2	2	1

1 — Most suitable 2 — Acceptable 3 — Least suitable

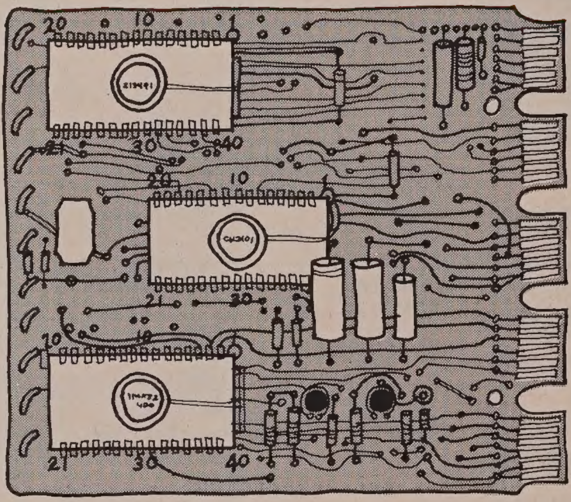
GENERAL ELECTRIC'S

TermiNet

Fast and Quiet

10, 15, or 30 characters per second...more than twice the speed of conventional equipment, so you get the most from today's high-speed data generation and communication equipment. This can mean big savings — in your office, in computer time and in the use of communication lines. This extra quiet impact printer makes less noise than an office typewriter, so it can be where it is needed... where your people are.

...Highly Reliable



The TermiNet 300 printer is basically an electronic device with a minimum of mechanical parts. There is no moving carriage and the electronic keyboard has a light touch for rapid, accurate typing. You also get high reliability and compactness by the use of large-scale integrated circuitry.

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* Trademark of General Electric Company

*300
TermiNet 300
GENERAL ELECTRIC

For
Time Sharing
Point-to-Point Data Exchange
Management Information Systems

...Versatile

- **Time sharing**
- **Point-to-point data exchange**
- **Editing and formating**
- **Management information systems**
- **Information retrieval**
- **Repetitive printing**
- **Computer input/output**

Whatever your application, this highly versatile data communication printer has a lot to offer. Impact printing can give you clear, multiple copies. Fast printout and a full ASCII character set means less time spent on communication lines.

The TermiNet 300 printer's compact, highly portable, "go anywhere" size saves you money, too. Because now you can put it where you want it...when you want it.

...And More

Many options are available to tailor GE's TermiNet 300 printers to your specific requirements.

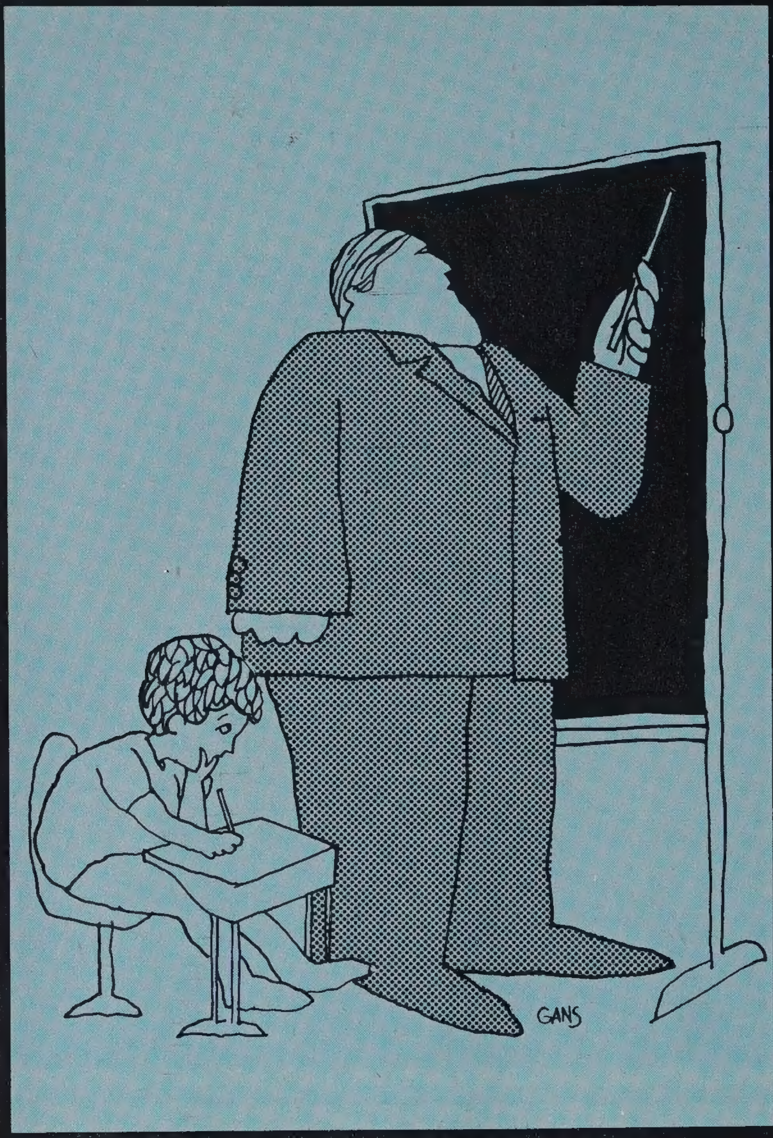
- **PIN FEED.** For rapid, accurate handling of business forms.
- **PARALLEL INTERFACE.** To accept data in parallel form and utilize associated devices.
- **HORIZONTAL TABULATION.** For quickly setting tabs at every print position. This aid in formating output data can be done from a remote location, or on the local keyboard.
- **BUILT-IN DATA SET.** Available as a plug-in board. Completely eliminates the need for a separate expensive data set.

That's just a few...there are many more. Even if you don't want or need all of the available options now, most can be added at a later date.

TermiNet 300 data communication printers are now in full-scale production. Want more information? Write Section 794-01, General Electric Co., Lynchburg, Virginia 24502.

GENERAL ELECTRIC

INFORMATION RETRIEVAL NUMBER 6



Did you find school dismal and dreary?
Did it turn you off?
Here the author proposes safe and legal ways to turn kids on.

NO MORE TEACH

by Theodor H. Nelson
The Nelson Organization
New York

Some think the educational system is basically all right, and more resources would get it working again. Schools would do things the same way, except more so, and things would get better.

In that case the obvious question would be, how can computers help? How can computers usefully supplement and extend the traditional and accepted forms of teaching? This is the question to which present-day efforts in "computer-assisted instruction" — called CAI — seem to respond.

But such an approach is of no possible interest to the new generation of critics of our school system — people like John Holt (*Why Children Fail*), Jonathan Kozol (*Death at an Early Age*) and James Herndon (*The Way It Spozed To Be*). More and more, such people are severely questioning the general framework and structure of the way we teach.

These writers describe particularly ghastly examples of our schooling conditions. But such horror stories aside, we are coming to recognize that schools as we know them appear designed at every level to sabotage the supposed goals of education. A child arrives at school bright and early in his life. By drabness we deprive him of interests. By fixed curriculum and sequence we rob him of his orientation, initiative and motivation, and by testing and scoring we subvert his natural intelligence.

Schools as we know them all run on the same principles: iron all subjects flat and then proceed, in groups, at a forced march across the flattened plain. Material is dumped on the students and their responses calibrated; their interaction and involvement with the material is not encouraged nor taken into consideration, but their dutifulness of response is carefully monitored.

While an exact arrangement of intended motivations for the student is preset within the system, they do not usually take effect according to the ideal. It is not that students are *un*motivated, but motivated *askew*. Rather than seek to achieve in the way they are supposed to, students turn to churlishness, surliness, or intellectual sheepishness. A general human motivation is god-given at the beginning and warped or destroyed by the educational process as we know it; thus we internalize at last that most fundamental of grownup goals: just to get through another day.

Because of this procedure our very notion of human ability has suffered. Adult mentality is cauterized, and we call it "normal." Most people's minds are mostly turned off most of the time. We know virtually nothing of human abilities except as they have been pickled and boxed in schools; we need to ignore all that and start fresh. To want students to be "normal" is criminal, when we are all so far below our potential. Buckminster Fuller, in *I Seem To Be A Verb*, says we are all born geniuses; Sylvia Ashton-Warner tells us in *Teacher* of her success with this premise, and of the brilliance and creative potential she was able to find in all her schoolchildren.

Curricula themselves destructively arrange the study situation. By walls between artificially segregated "studies" and "separate topics" we forbid the pursuit of interest and kill motivation.

RS'DIRTY LOOKS

In ordinary schooling, the victim cannot orient himself to the current topic except by understanding the official angle of approach and presentation. Though tie-ins to previous interests and knowledge are usually the best way to get an initial sense of a thing, there is only time to consider the officially presented tie-ins. (Neither is there time to answer questions, except briefly and rarely well — and usually in a way that promotes "order" by discouraging "extraneous" tie-ins from coming up.)

The unnecessary division and walling of subjects, sequencing and kibbling of material lead people to expect simplifications, to feel that naming a thing is understanding it, to fear complex wholes; to believe creativity means recombination, the parsing of old relations, rather than synthesis.

Like political boundaries, curriculum boundaries arise from noticeable features of a continuum and become progressively more fortified. As behind political borders, social unification occurs within them, so that wholly dissimilar practitioners who share a name come to think they do the same thing. And because they talk mainly to each other, they forget how near is the other side of the border.

Because of the fiction of "subjects," great concern and consideration has always gone into calculating the "correct" teaching sequence for each "subject." In recent years radical new teaching sequences have been introduced for teaching various subjects, including mathematics and physics. But such efforts appear to have been misinformed by the idea of supplanting the "wrong" teaching sequence with the "right" teaching sequence, one which is "validated." Similarly, we have gone from a time when the instructional sequence was a balance between tradition and the lowest common denominator of each subject, to a time when teachers may pick "flexible optimized strategies" from text-

© Walt Disney Productions

If the computer is a universal control system, let's give kids universes to control.

Some premises relevant to teaching

1. The human mind is born free, yet everywhere it is in chains. The educational system serves mainly to destroy for most people, in varying degrees, intelligence, curiosity, enthusiasm, and intellectual initiative and self-confidence. We are born with these. They are gone or severely diminished when we leave school.
2. Everything is interesting, until ruined for us. Nothing in the universe is intrinsically uninteresting. Schooling systematically ruins things for us, wiping out these interests; the last thing to be ruined determines your profession.
3. There are no "subjects." The division of the universe into "subjects" for teaching is a matter of tradition and administrative convenience.
4. There is no natural or necessary order of learning. Teaching sequences are arbitrary, explanatory hierarchies philosophically spurious. "Prerequisites" are a fiction spawned by the division of the world into "subjects;" and maintained by not providing summaries, introductions or orientational materials except to those arriving through a certain door.
5. Anyone retaining his natural mental facilities can learn anything practically on his own, given encouragement and resources.
6. Most teachers mean well, but they are so concerned with promoting their images, attitudes and style of order that very little else can be communicated in the time remaining, and almost none of it attractively.

books. And this all ignores a simple fact: all are arbitrary. Instructional sequences aren't needed at all if the people are motivated and the materials are clear and available.

Testing as we know it (integrated with walled curricula and instructional sequences) is a destructive activity, particularly for the orientation which it creates. The concerns of testing are extraneous: learning to figure out low-level twists in questions that lead nowhere, under pressure.

The system of tensions and defenses it creates in the student's personality are unrelated to the subject or the way people might relate to the subject. An exploitive attitude is fostered. Not becoming involved with the subject, the student grabs for rote payoff rather than insight.

All in a condescending circumstance. Condescension is built into the system at all levels, so pervasive it is scarcely noticed. Students are subjected to a grim variety of put-downs and denigrations. While many people evidently believe this to be right, its productivity in building confident and self-respecting minds may be doubted.

The problems of the school are not particularly the teacher's fault. The practice of teaching is principally involved with managing the class, keeping up face, and projecting the image of the subject that conforms to the teacher's own predilections. The educational system is thereby committed to the fussy and prissy, to the enforcement of peculiar standards of righteousness and the elevation of teachers—a huge irrelevant shell around the small kernel of knowledge transmitted.

The usual attacks on computer teaching tend to be sentimental and emotional pleas for the alleged humanism of the existing system. Those who are opposed to the use of computers to teach generally believe the computer to be "cold" and "inhuman." The teacher is considered "warm" and "human." This view is questionable on both sides.

The computer is as inhuman as we make it. The computer is no more "cold" and "inhuman" than a toaster, bathtub or automobile (all associated with warm human activities). Living teachers can be as inhuman as members of any people-prodding profession, sometimes more so. Computerists speak of "freeing teachers for the creative part of their work;" in many cases it is not clear what creative tasks they could be freed for.

At the last, it is to *rescue* the student from the inhuman teacher, and allow him to relate directly and personally to the intrinsically interesting subject matter, that we need to use computers in education.

Many successful systems of teacherless learning exist in our society: professional and industrial magazines; conventions and their display booths and brochures; technical sales pitches (most remarkably, those of medical "detail men"); hobbyist circles, which combine personal acquaintance with a round of magazines and gatherings; think-tanks and research institutes, where specialists trade fields; and the respectful briefing.

None of these is like the conventional classroom with its haughty resource-chairman; they are not run on condescension; and they get a lot across. We tend to think they are not "education" and that the methods cannot be transferred or extended to the regions now ruled by conventional teaching. But why not?

If everything we ate were kibbled into uniform dogfood, and the amount consumed at each feeding time tediously watched and tested, we would have little fondness for eating. But this is what the schools do to our food for thought, and this is what happens to people's minds in primary school, secondary school and most colleges.

This is the way to produce a nation of sheep or clerks. If we are serious about wanting people to have creative and energetic minds, it is not what we ought to do. Energy and enthusiasm are natural to the human spirit; why drown them?

Education ought to be clear, inviting and enjoyable, without booby-traps, humiliations, condescension or boredom. It ought to teach and reward initiative, curiosity, the habit of self-motivation, intellectual involvement. Students should develop, through practice, abilities to think, argue and disagree intelligently.

Educators and computer enthusiasts tend to agree on these goals. But what happens? Many of the inhumanities of the existing system, no less wrong for being unitentional, are being continued into computer-assisted teaching.

Although the promoters of computer-assisted instruction, affectionately called "CAI," seem to think of themselves as being at the vanguard of progress in all directions, the field already seems to operate according to a stereotype. We may call this "classic" or "conventional" CAI, a way of thinking depressingly summarized in "*The Use of Computers in Education*" by Patrick Suppes, Scientific American, September, 1966, 206-220, an article of semi-classic stature.

It is an unexamined premise of this article that the computer system will always decide what the student is to study and control his movements through it. The student is to be led by the nose through every subject, and the author expresses perplexity over the question of *how* the system can decide, at all times, *where* to lead the student by the nose (top of col. 3, p. 219). But let us not anticipate alternatives.

It is often asserted (as by Alpert and Bitzer in *"Advances in Computer-Based Education,"* Science, March 20, 1970) that this is not the only approach current. The trouble is that it *seems* to be the only approach current, and in the expanding computer universe everyone seems to know what CAI "is." And this is it.

Computer-assisted instruction, in this classical sense, is the presentation by computer of bite-sized segments of instructional material, branching among them according to involuntary choices by the student ("answers") and embedding material presented the student in some sort of pseudo-conversation ("Very good. Now, Johnny, point at the . . .")

CAI: Based on unnecessary premises

At whichever level of complexity, all these conventional CAI systems are based on three premises: that all presentations consists of *items,* short chunks and questions; that the items are arranged into *sequences,* though these sequences may branch and vary under control of the computer; and finally, that these sequences are to be embedded in a framework of *dialogue;* with the computer composing sentences and questions appropriately based on the student's input and the branching structure of the materials. Let us call such systems SIC (Sequenced-Item Conversational) systems.

These three premises are united. For there to be dialogue means there must be an underlying graph structure of potential sequences around which dialogue may be generated; for there to be potential sequences means breakpoints, and hence items.

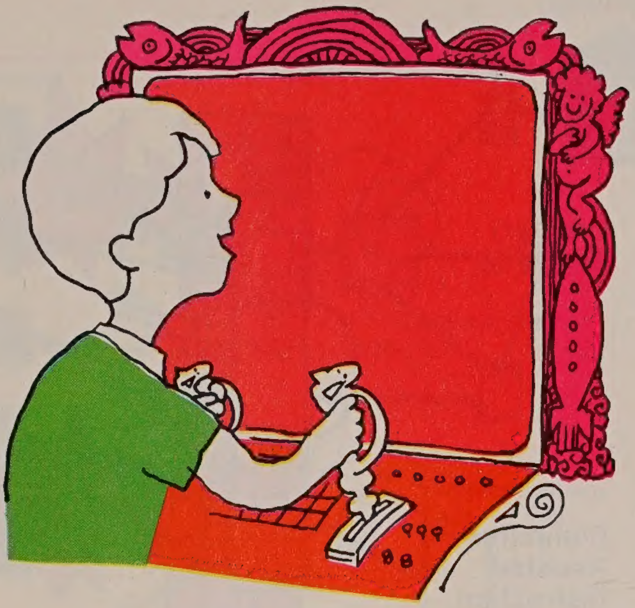
Let us question each of the premises in turn.

1. **Is dialogue pleasant or desirable?** Compulsory interaction, whether with a talking machine or a stereotyped human, is itself a put-down or condescension. (Note that on superhighways there is often a line of cars behind the automatic toll booths, even when the manned ones are open.) Moreover, faked interaction can be an annoyance. (Consider the green light at the automatic toll booth that lights up with a "thank you.") Moreover, dialogue by simple systems tends to have a fake quality. It is by no means obvious that phony dialogue with a machine will please the student.

2. **Is the item approach necessary?** If the student were in control, he could move around in areas of material, leaving each scene when he got what he wanted, or found it unhelpful.

3. **Are sequences necessary?** Prearranged sequences become unnecessary if the student can see what he has yet to learn, then pursue it.

The sense of prestige and participation



CAI: unnecessary complication

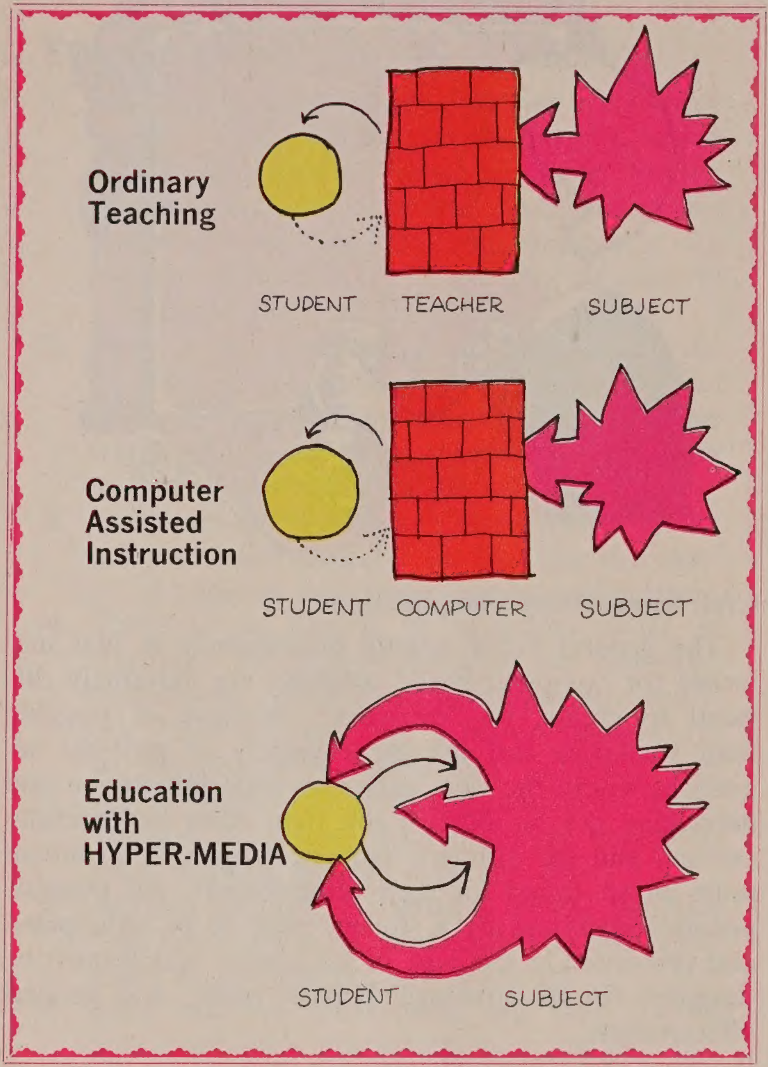
The general belief among practitioners is that materials for computer-based teaching are extremely difficult to create, or "program." Because of possible item weakness and the great variety of possible sequences within the web, extensive experimentation and debugging are required. Each item must be carefully proven; and the different sequences open to a student must all be tested for their effectiveness. All possible misunderstandings by a student need to be anticipated and prevented in this web of sequences, which must be designed for its coverage, correct order, and general effectiveness.

CAI: general wrongfulness

Computers offer us the first real chance to let the human mind grow to its full potential, as it cannot within the stifling and insulting setting of existing school systems. Yet most of the systems for computer-assisted instruction seem to me to be perpetuating and endorsing much that is wrong, even evil, in our present educational system. CAI in its conventional form enlarges and extends the faults of the American educational system itself. They are:

- Conduciveness to boredom;
- The removal of opportunities for initiative;
- Gratuitous concerns, both social and administrative ("subject," "progress" in subject);
- Grades, which really reflect commitment level, anxiety, and willingness to focus on core emphasis;
- Stereotyped and condescending treatment of the student (the "Now-Johnny" box in the computer replacing the one that sits before the class);
- The narrowing of curricula and available materials for "results" at the expense of motivation and generalized orientation;
- Destructive testing of a kind we would not permit on delicate machinery; and,
- An overt or hidden emphasis on invidious ratings. (Ungraded schools are nice—but how many units did *you* complete today?).

There are of course improvements, for instance in the effects of testing. In the tell-test, tell-test nattering of CAI, the testing becomes merely an irritant, but one certainly not likely to foster enthusiasm.



But isn't CAI 'scientific?'

Part of CAI's mystique is based upon the idea that teaching can become "scientific" in the light of modern research, especially learning theory. It is understandable that researchers should promote this view and that others should fall for it.

Laymen do not understand, nor are they told, that "learning theory" is an extremely technical, mathematically oriented, description of the behavior of abstract and idealized organisms learning non-unified things under specific conditions of motivation and non-distraction.

Let us assume, politely, that learning theory is a full and consistent body of knowledge. Because of its name, learning theory has at least what we may call nominal relevance to teaching; but real relevance is another matter. It may be relevant as Newtonian equations are to shooting a good game of pool: implicit but without practical bearing.

Because of the actual character of learning theory, and its general remoteness from non-sterile conditions, actual relevance to any particular type of application must still be demonstrated. To postulate that the theory still applies in diluted or shifted circumstances is a leap of faith. Human beings are not, taken all together, very like the idealized pigeons or rats of learning theory, and their motivations and other circumstances are not easily controlled. Studies concerned with rate of repetition and reinforcement are scarcely relevant if the student hates or does not understand what he is doing.

I do not mean to attack all CAI, or any teaching system which is effective and gratifying. What I doubt is that SIC systems for CAI will become more and more wonderful as effort progresses, or that the goal of talking tutorial systems is reachable and appropriate. And what I further suspect is that we are building boredom systems that not only make life duller but sap intellectual interest in the same old way.

Should systems 'instruct?'

Drill-and-practice systems are definitely a good thing for the acquisition of skills and response sets, an improvement over workbooks and the like, furnishing both corrections and adjustment. They are boring, but probably less so than the usual materials. But the CAI enthusiasts seem to believe the same conversationalized chunk techniques can be extented to the realm of ideas, to systems that will tutor and chide, and that this will provide the same sort of natural interest provided by a live tutor's instruction.

The conventional point of view in CAI claims that because validation is so important, it is necessary to have a standardized format of item, sequence and dialogue. This justifies turning the endeavor into pickywork within items and sequence complexes, with attendant curricular freeze, and student inanition and boredom. This is entirely premature. The variety of alternative systems for computer teaching have not even begun to be explored. Should systems "instruct" at all?

'Responding Resources' and 'Hyper-Media'

At no previous time has it been possible to create learning resources so responsive and interesting, or to give such free play to the student's initiative as we may now. We can now build computer-based presentational wonderlands, where a student (or other user) may browse and ramble through a vast variety of writings, pictures and apparitions in magical space, as well as rich data structures and facilities for twiddling them. These we may call, collectively, "responding resources." Responding resources are of two types: facilities and hyper-media.

A *facility* is something the user may call up to perform routinely a computation or other act, behaving in desired ways on demand. Thus JOSS (a clever desk calculator available at a terminal) and the Culler-Freed graph-plotting system (which graphs arbitrary functions the user types in) are facilities.

Hyper-media are branching or performing presentations which respond to user actions, systems of prearranged words and pictures (for example) which may be explored freely or queried in stylized ways. They will not be "programmed," but rather *designed, written, drawn* and *edited,* by authors, artists, designers and editors. (To call them "programmed" would suggest spurious technicality. Computer systems to present them will be "programmed.") Like ordinary prose and pictures, they will be *media;* and because they are in some sense "multi-dimensional," we may call them *hyper-media,* following the mathematical use of the term "hyper-".

A modest proposal

The alternative is straightforward. Instead of devising elaborate systems permitting the computer or its instructional contents to control the situation, why not permit the student to control the system, show him how to do so intelligently, and make it easy for him to find his own way? Discard the sequences, items and conversation, and allow the student to move freely through materials which he may control. Never mind optimizing reinforcement or validating teaching sequences. Motivate the user and let him loose in a wonderful place.

Let the student control the sequence, put him in control of interesting and clear material, and make him feel good—comfortable, interested, and autonomous. Teach him to orient himself: not having the system answer questions, all typed in, but allowing the student to get answers by looking in a fairly obvious place. (Dialogue is unnecessary even when it does not intrude.) Such ultra-rich environments allow the student to choose what he will study, when he will study it and how he will study it, and to what criteria of accomplishment he will aim. Let the student pick what he wishes to study next, decide when he wishes to be tested, and give him a variety of interesting materials, events and opportunities. Let the student ask to be tested on what he thinks he knows, when he is ready, selecting the most appropriate form of testing available.

This approach has several advantages. First, it circumvents the incredible obstacles created by the dialogue-item-sequence philosophy. It ends the danger to students of bugs in the material. And last, it does what education is supposed to do—foster student enthusiasm, involvement, and self-reliance.

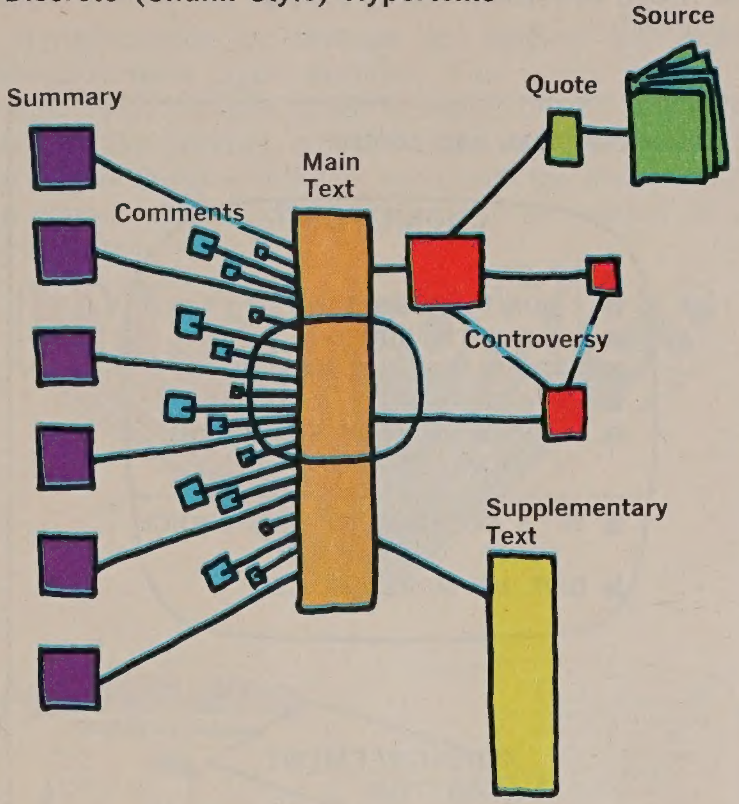
Under such circumstances students will actually be interested, motivated to achieve far more than they have ever achieved within the normal instructional framework; and any lopsidedness which may result will be far offset by the degree of accomplishment which will occur—it being much better to create lopsided but enthusiastic genius specialists than listless, apathetic, or cruelly rebellious mediocrities. If they start soon enough they may even reach adulthood with natural minds: driven by enthusiasm and interest, crippled in no areas, eager to learn more, and far smarter than people ordinarily end up being.

Enthusiasm and involvement are what really count. This is why the right to explore far outweighs any administrative advantages of creating and enforcing "subjects" and curriculum sequences. The enhancement of motivation that will follow from letting kids learn anything they want to learn will far outweigh any specialization that may result. By the elimination or benign replacement of both curriculum and tests in an ultra-rich environment, we will prevent the attrition of the natural motivation of children from its initially enormous levels, and mental development will be the natural straight diagonal rather than the customary parabola.

Is it so hard? some ideas

CAI is said to be terribly hard. It would seem all the harder, then, to give students the richer and more stimulating environments advocated here. This is because of the cramped horizons of computer teaching today. Modest goals have given us modest visions, far below what is now possible and will soon be cheap.

Discrete (Chunk Style) Hypertexts



The static computer displays now associated with CAI will give way to dynamic displays driven from minicomputers, such as the IDIIOM, IBM 2250/4 or Imlac PDS-1. (The last of these costs only $10,000 *now;* by 1975 such a unit will probably cost $1,000 or less.) Not only will computers be much cheaper, but their usability will improve: a small computer with a fair amount of memory will be able to do much more than it can now, including operate a complex display from its own complex data base.

It is generally supposed that systems like these need big computers and immense memories. This is not true if we use the equipment well, organize storage cleverly, and integrate data and display functions under a compact monitor. This is the goal of The Nelson Organization's Project Xanadu, a system intended to handle all the functions described here on a minicomputer with disk and tape.

Discrete hypertexts

"Hypertext" means forms of writing which branch or perform on request; they are best presented on computer display screens.

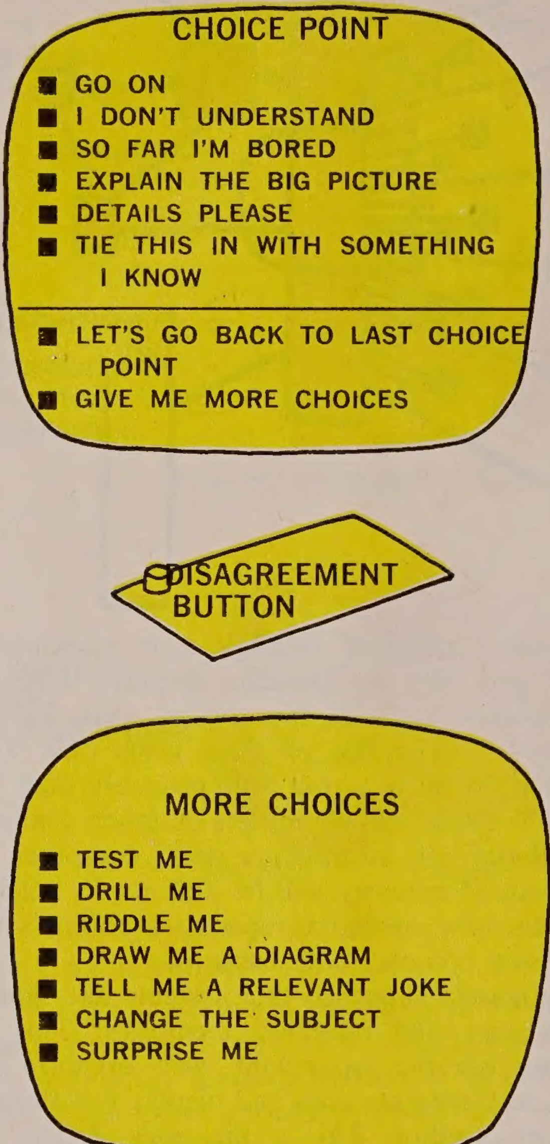
In ordinary writing the author may break sequence for footnotes or insets, but the use of print on paper makes some basic sequence essential. The computer display screen, however, permits footnotes on footnotes on footnotes, and pathways of any structure the author wants to create.

Discrete, or chunk style, hypertexts consist of separate pieces of text connected by links.

Ordinary prose appears on the screen and may be moved forward and back by throttle. An asterisk or other key in the text means, not an ordinary footnote, but a *jump*—to an entirely new presentation on the screen. Such jumpable interconnections become part of the writing, entering into the prose medium itself as a new way to provide explanations and details to the seeker. These links may be artfully arranged according to meanings or relations in the subject, and possible tangents in the reader's mind.

No more teachers' dirty looks
(continued)

Welcomingness and control



CHOICE POINT

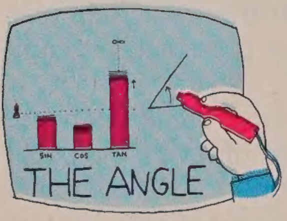
- ■ GO ON
- ■ I DON'T UNDERSTAND
- ■ SO FAR I'M BORED
- ■ EXPLAIN THE BIG PICTURE
- ■ DETAILS PLEASE
- ■ TIE THIS IN WITH SOMETHING I KNOW

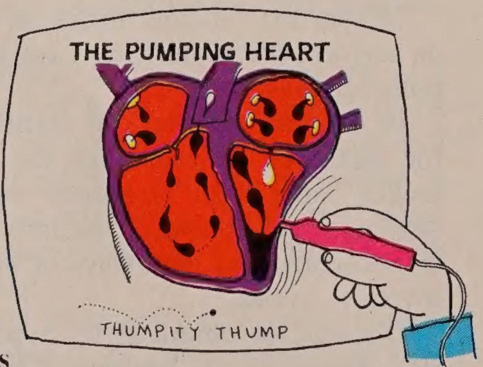
- ■ LET'S GO BACK TO LAST CHOICE POINT
- ■ GIVE ME MORE CHOICES

DISAGREEMENT BUTTON

MORE CHOICES

- ■ TEST ME
- ■ DRILL ME
- ■ RIDDLE ME
- ■ DRAW ME A DIAGRAM
- ■ TELL ME A RELEVANT JOKE
- ■ CHANGE THE SUBJECT
- ■ SURPRISE ME





Performing hypergrams

A hypergram is a performing or branching picture: for instance, this angle, with the bar-graph of its related trigonometric functions. The student may turn the angle upon the screen, seizing it with the light-pen, and watch the related trigonometric functions, displayed as bar charts, change correspondingly.

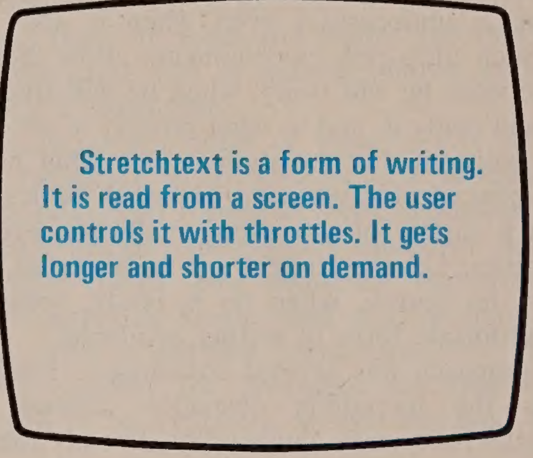
Hypergrams may also be programmed to show the consequences of a user's prod—what follows or accompanies some motion of the picture that he makes with a pointing tool, like the heartbeat sequence.

Stretchtext fills in the details

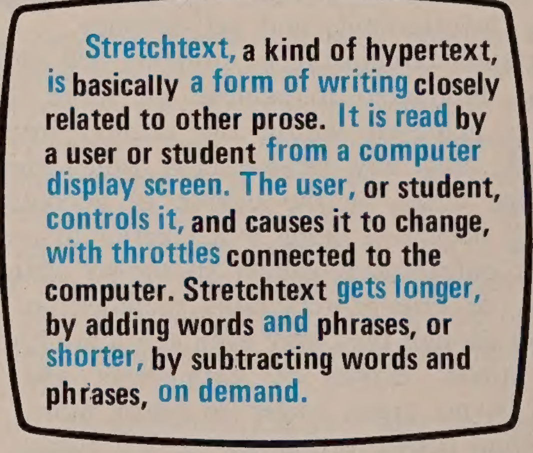
This form of hypertext is easy to use without getting lost. As a form of writing, it has special advantages for discursive and loosely structured materials—for instance historical narratives.

There are a screen and two throttles. The first throttle moves the text forward and backward, up and down on the screen. The second throttle causes changes in the writing itself: throttling toward you causes the text to become *longer* by minute degrees. Gaps appear between phrases; new words and phrases pop into the gaps, an item at a time. Push back on the throttle and the writing becomes shorter and less detailed.

The stretchtext is stored as a text stream with extras, coded to pop in and pop out at the desired altitudes:



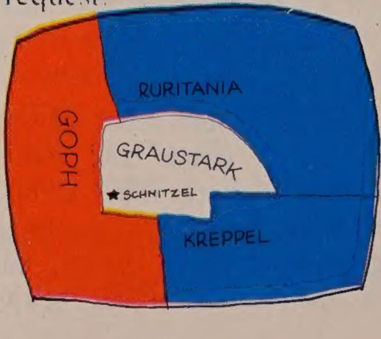
Stretchtext is a form of writing. It is read from a screen. The user controls it with throttles. It gets longer and shorter on demand.



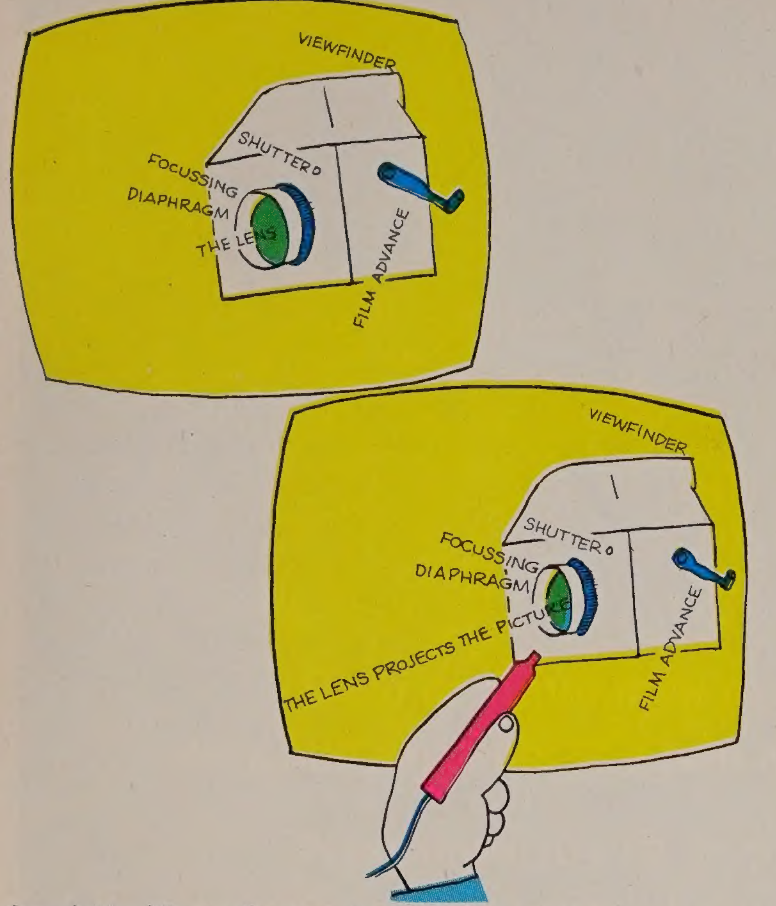
Stretchtext, **a kind of hypertext,** is **basically** a form of writing **closely related to other prose.** It is read **by a user or student** from a computer display screen. The user, **or student,** controls it, **and causes it to change,** with throttles **connected to the computer. Stretchtext** gets longer, **by adding words** and **phrases, or** shorter, **by subtracting words and phrases,** on demand.

Hypermap zips up or down

The screen is a map. A steering device permits the user to move the map around the world's surface; a throttle zooms it in. Not by discrete jumps, but animated in small changes, the map grows and grows in scale. More details appear as the magnification increases. The user may request additional display modes or "overlays," such as population, climate, and industry. Such additional features may pop into view on request.

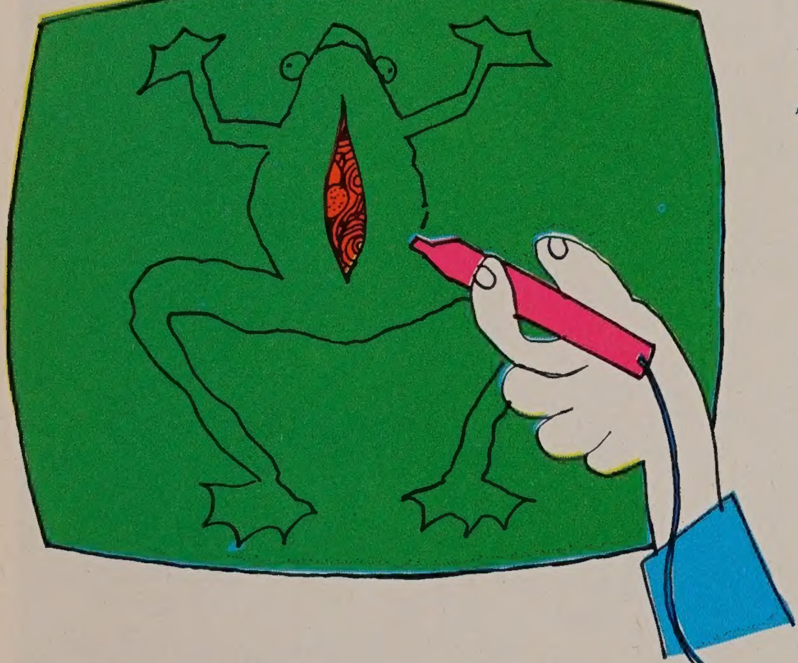


GRAUSTARK
SCHNITZEL
ZEL
SHADING


VIEWFINDER
SHUTTER
FOCUSSING DIAPHRAGM
THE LENS
FILM ADVANCE
VIEWFINDER
SHUTTER
FOCUSSING DIAPHRAGM
THE LENS PROJECTS THE PICTURE
FILM ADVANCE

Queriable illustrations: a form of hypergram

A "hypergram" is a picture that can branch or perform on request. In this particular example, we see on the screen a line-drawing with protruding labels. When the student points at a label, it becomes a sliding descriptive ribbon, explaining the thing labelled. Or asterisks in an illustration may signal jumps to detailed diagrams and explanations, as in discrete hypertexts.

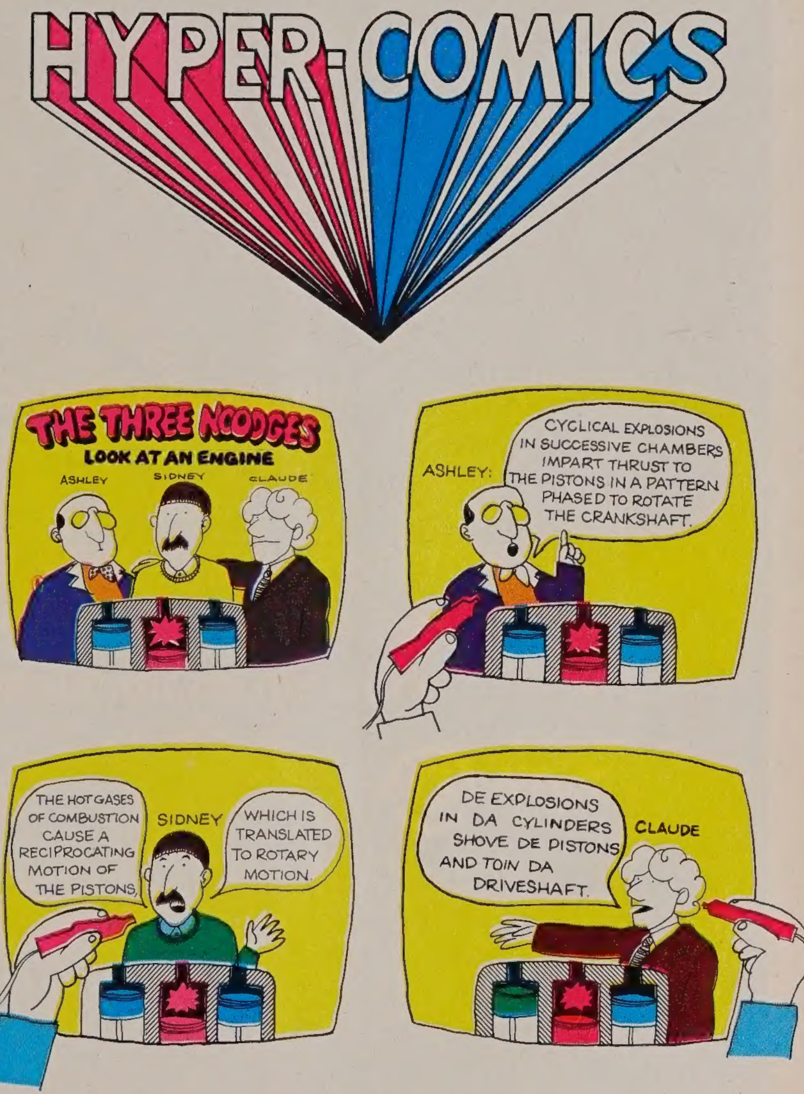


Dissection on the screen

The student of anatomy may use his light-pen as a scalpel for a deceased creature on the screen. As he cuts, the tissue parts. He could also turn the light-pen into hemostat or forceps, and fully dissect the creature —or put it back together again. (This need not be a complex simulation. Many key relationships can be shown by means of fairly simple schematic pictures, needing a data structure not prohibitively complicated.)

Hyper-comics are fun

Hyper-comics are perhaps the simplest and most straightforward hyper-medium. The screen holds a comic strip, but one which branches on the student's request. For instance, different characters could be used to explain things in different ways, with the student able to choose which type of explanation he wanted at a specific time.

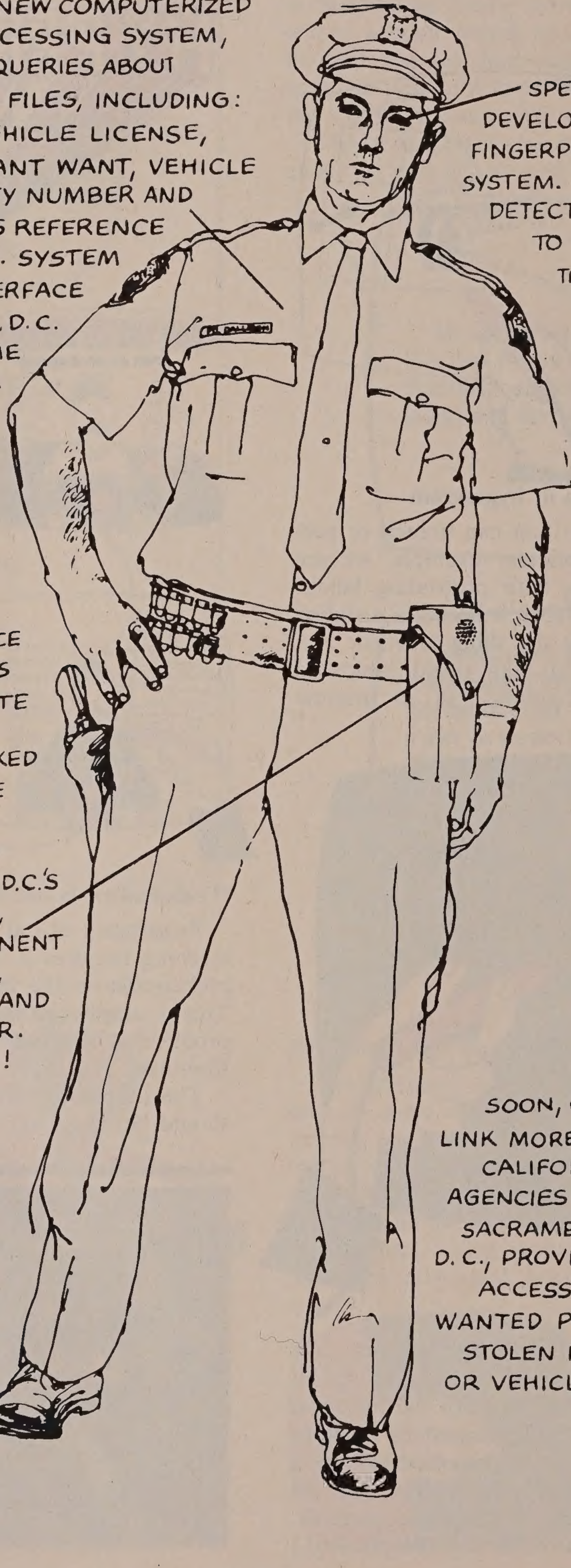

HYPER-COMICS
THE THREE NOODGES
LOOK AT AN ENGINE
ASHLEY
SIDNEY
CLAUDE
ASHLEY:
CYCLICAL EXPLOSIONS IN SUCCESSIVE CHAMBERS IMPART THRUST TO THE PISTONS IN A PATTERN PHASED TO ROTATE THE CRANKSHAFT.
THE HOT GASES OF COMBUSTION CAUSE A RECIPROCATING MOTION OF THE PISTONS,
SIDNEY
WHICH IS TRANSLATED TO ROTARY MOTION.
DE EXPLOSIONS IN DA CYLINDERS SHOVE DE PISTONS AND TOIN DA DRIVESHAFT.
CLAUDE

'Technicality' is not necessary

Proponents of CAI want us to believe that scientific teaching requires a certain setup and format, incomprehensible to the layman and to be left to experts. This is simply not true. "Technicality" is a myth. The problem is not one of technical rightness, but what *should* be.

The suggestions that have been given are things that should be; they will be brought about. ☐

Ted Nelson, president of The Nelson Organization, calls himself "a cynical romantic, a computopian." He believes on the one hand that "there are a lot of naked emperors around computerdom," and on the other that "the computer may offer our only hope for the rehumanization of society." Nelson, with the help of some youngsters, is presently implementing some of the multi-dimensional information storage concepts mentioned toward the end of the article.



OUR NETWORK ALLOWS AN UNDERMANNED POLICE FORCE TO PROTECT LARGE POPULATION AREAS. IN SECONDS, ALERT, A NEW COMPUTERIZED TELEPROCESSING SYSTEM, ANSWERS QUERIES ABOUT SEVERAL FILES, INCLUDING: NAME, VEHICLE LICENSE, WARRANT WANT, VEHICLE IDENTITY NUMBER AND CROSS REFERENCE INDEX FILE. SYSTEM CAN ALSO INTERFACE WITH FBI'S, WASHINGTON, D.C. NATIONAL CRIME INFORMATION CENTER.

SPECIALISTS ARE DEVELOPING A COMPUTERIZED FINGERPRINT CLASSIFICATION SYSTEM. USING OUR NETWORK, DETECTIVES WILL BE ABLE TO IDENTIFY "SCENE OF THE CRIME" FINGERPRINTS WITHIN SECONDS.

OUR NETWORK LETS POLICE CHECK OUT SUSPICIOUS CARS BY RADIO. OUT-OF-STATE LICENSES ARE CALLED TO HEADQUARTERS AND CHECKED THROUGH THE STATE POLICE COMPUTER SYSTEM. IF NECESSARY, THEY ARE ALSO RUN THROUGH WASHINGTON, D.C.'S SYSTEM. IF A CAR IS STOLEN, COMPUTER TRANSMITS PERTINENT FACTS, VIA TELETYPEWRITER, BACK TO HEADQUARTERS AND THEN TO WAITING PATROL CAR. ALL WITHIN 15 SECONDS!

SOON, OUR NETWORK WILL LINK MORE THAN 450 CALIFORNIA LAW ENFORCEMENT AGENCIES TO CRIME FILES IN SACRAMENTO AND WASHINGTON D.C., PROVIDING INSTANT ACCESS TO INFORMATION ON WANTED PERSONS, LOST OR STOLEN PROPERTY, FIREARMS OR VEHICLES.

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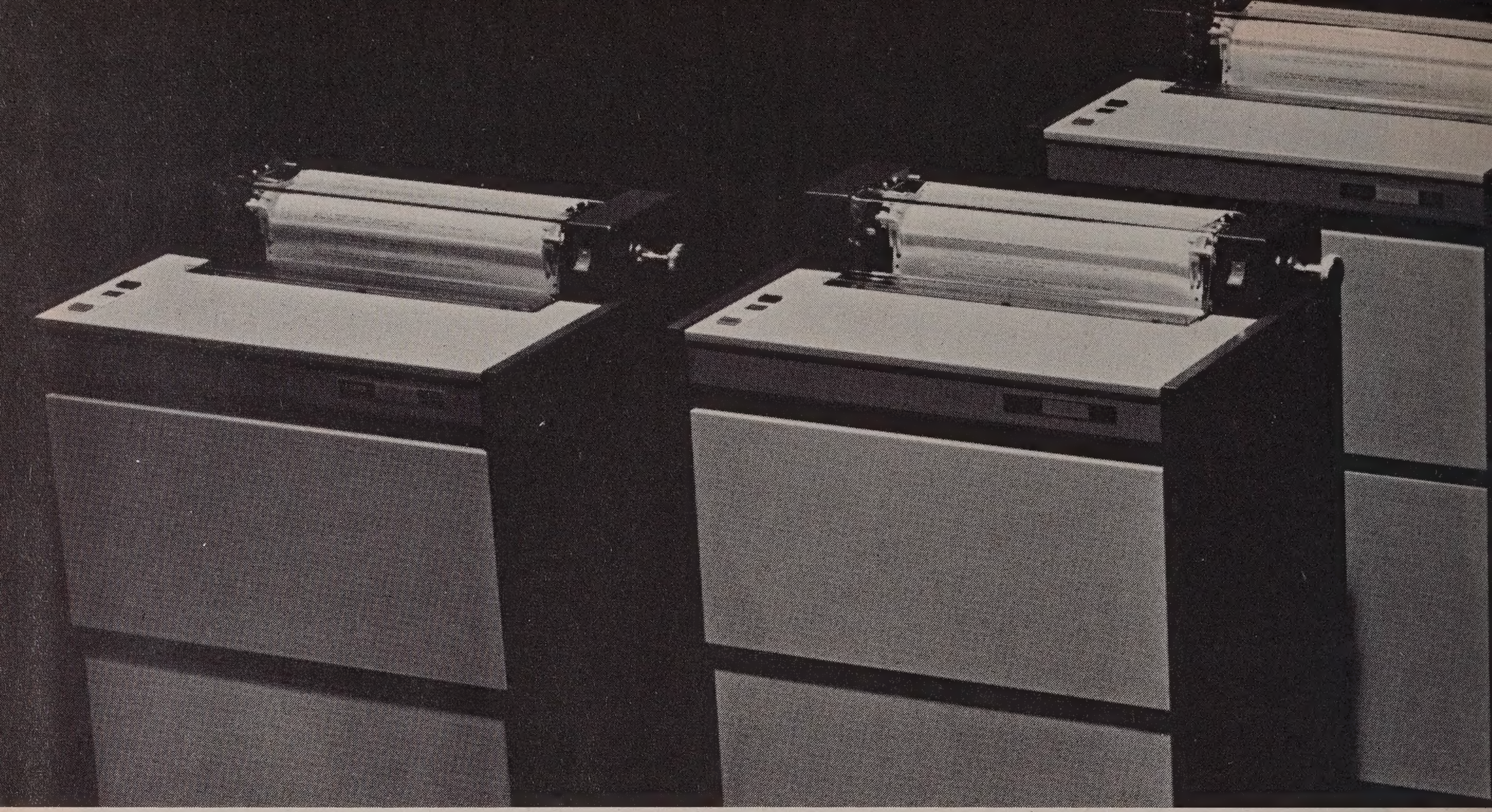

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INFORMATION RETRIEVAL NUMBER 8

Be mean about management reporting

by **Dr. Norbert L. Enrick**
Kent State University
Kent, Ohio

So thunderous has been the outpouring of data in many management information systems, that staff and executives alike often feel engulfed. The choice between wading through miles of computer print-out for the needed information, or simply ignoring the available data, is not a happy one. However, relief may be found by using a system that provides reports mainly on an exception basis, that is to say, when some variable, such as overhead costs, falls outside certain set limits. One method of determining when to issue exception reports is control chart methodology. It affords an efficient and rational application of the exception principle of management.

Setting limits for quality control

Control chart analysis originated in production and engineering management as an aid in quality control. Because of some variability in materials, processes, measuring techniques and ambient conditions, proper control of quality distinguishes between chance, and, therefore allowable, variations in dimensional, strength, or other characteristics of the product and significant or assignable causes of variation. The pertinent distinguishing criterion is the control limit. When actual test results, plotted on a time-chart, fail to stay within allowable limits, the probable presence of trouble in the processing equipment, the material being fed or the method of operation is signaled. Corrective action is thus called for. But a certain risk of error remains. For example, limits set at a 95 percent confidence level incur a five percent risk of signaling trouble when actually none exists. Management decides on the level of risk to establish. The risk could be reduced to one percent, for example, but this involves more testing and consequently higher costs.

The control limits are based on the statistical idea that measured variables are usually distributed about a mean in some regular fashion, often referred to as a normal distribution. The possibility that one measured value will fall at the extremities of the normal distribution can be easily estimated from standard formulas and charts. However, no complex math is required to make use of the formulas and charts. A few examples will show how the approach works.

Controlling variable costs

As an example of control chart procedures, let's consider a manufacturing company with both fixed and variable overheads. Variable overhead (Table 1) can be measured as a percent of direct labor cost. In 1967 the standard was ten percent, but in 1968 and 1969 it was increased, first to twelve and then to fifteen percent, to reflect reduced direct labor as a result of automation. The steps in forming the control charts are:

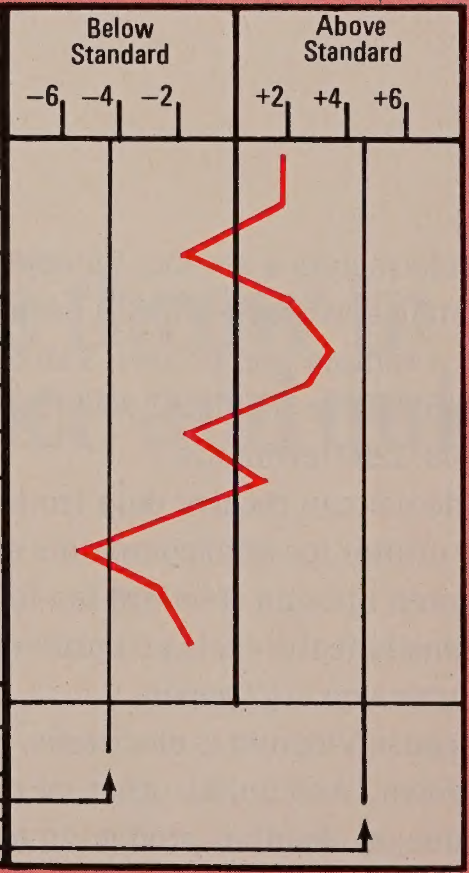
Establish typical patterns of variability from past data. The first two years are used for this purpose. Since

Table 1: Variable overhead

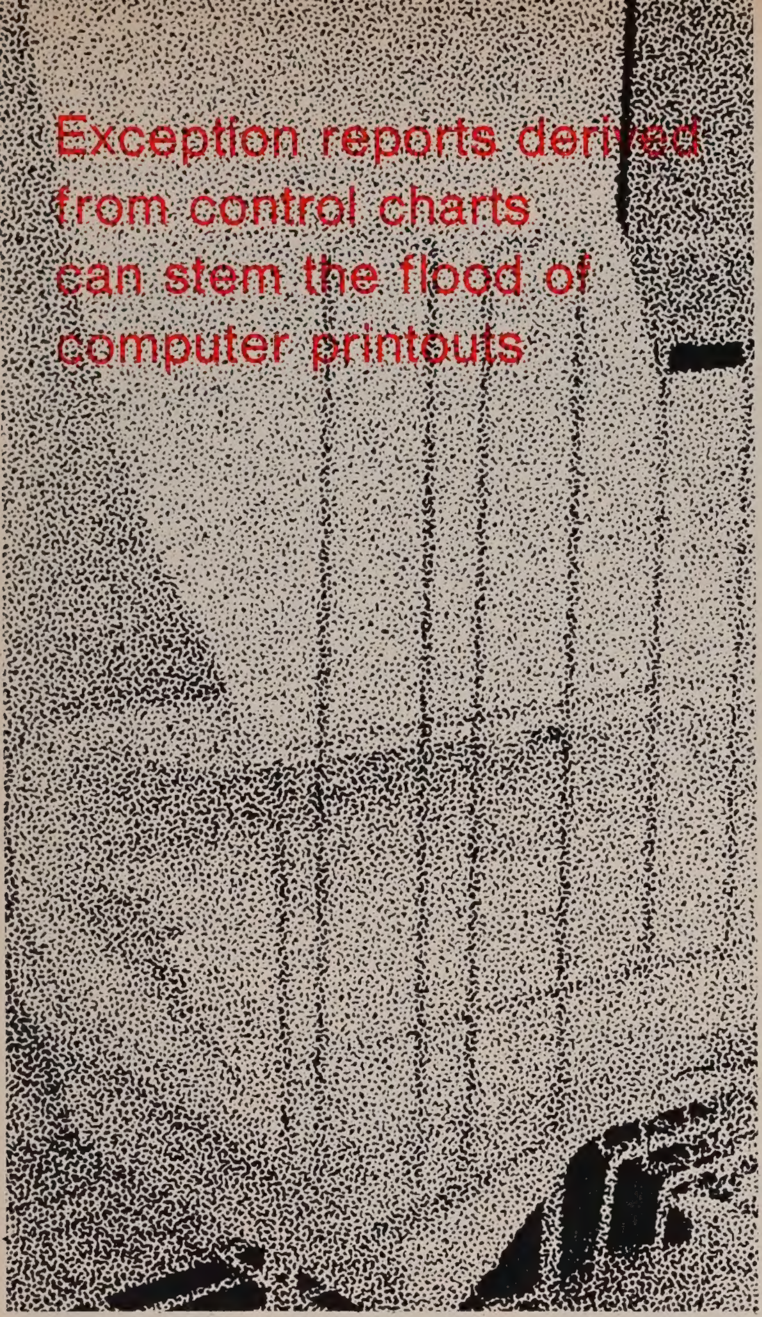
Year + Quarter		Standard	Actual	Deviation from Standard	Range
'67	I	10	12	+2	
	II		12	+2	0
	III		8	−2	4
	IV		12	+2	4
'68	I	12	14	+4	2
	II		15	+3	1
	III		10	−2	5
	IV		12	0	2
'69	I	15	10	−5	
	II		12	−3	
	III		13	−2	
	IV				
Total of ranges					= 18
Average range = 18/7					= 2.6

Lower control limit = −2.6 x 1.8 = −4.7

Upper control limit = 2.6 x 1.8 = 4.7



The first eight quarters establish the typical patterns from which the control limits are calculated. The first quarter of 1969 shows an out--of-control condition. The figure used in calculating the limits comes from Table 2.



Exception reports derived from control charts can stem the flood of computer printouts

the standards varied from 1967 to 1968, the deviations of actual results from standard are used for control. Thus in the third quarter of 1967, the actual cost of eight percent deviates by two percentage points from the standard percentage variable cost of 10 percent.

Establish the past pattern of variability, as reflected by the successive ranges. For example, for the first and second quarters of 1967, the deviations from standard were two percent. The range, representing the difference between these two values, is zero. Next, between the second and the third quarters of 1967, the difference is 2 − (−2) = 4. Ranges are always shown as absolute, hence positive differences. From all seven individual ranges an average of 2.6 is obtained.

Using a set of limit factors, calculate the control limits. The control limit factors are obtained from a standard table based on a normal (Gaussian) law of errors and a 95 percent confidence level. From Table 2, the control limits are:

limits = goal value ± (average range) x F_i

limits = 0 ± (2.6 x 1.8) = 4.7 and −4.7

The goal value is zero because we wish to deviate by zero from the standard ratio for variable overhead as a percent of direct labor.

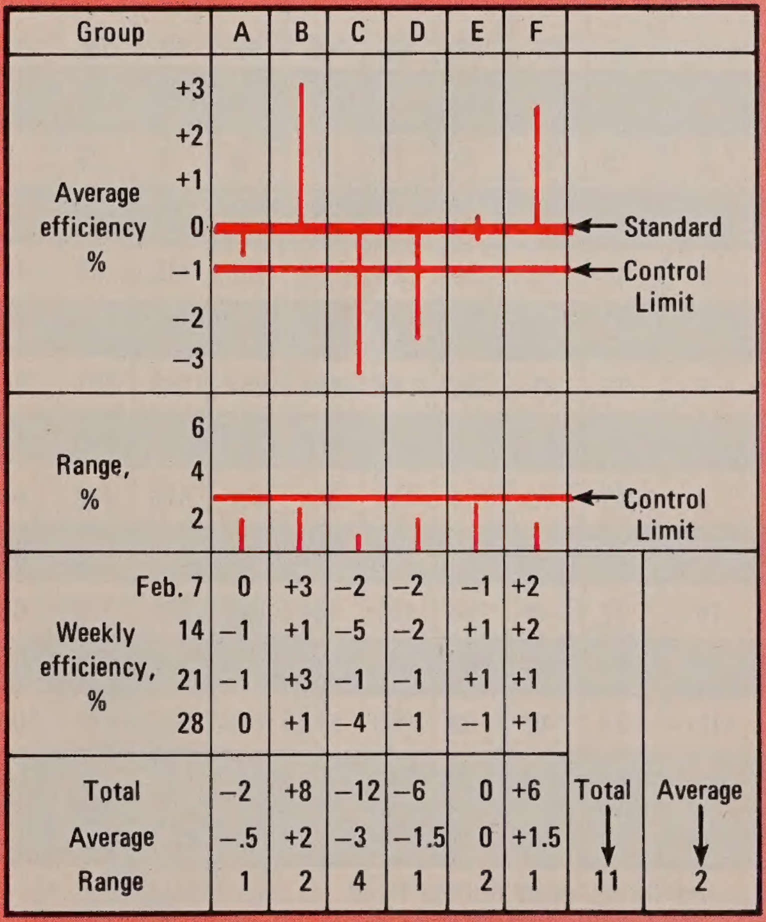
In this control chart, an out-of-control point occured in the first quarter of 1969. A shortage had developed of skilled technicians for the purpose of product inspection and machine maintenance. As a result, management was not attaining requisite quality and reliability of output. At the same time inadequate maintenance frequencies threatened an adverse effect on the life of equipment. Deficiencies in the firm's training and recruiting program were noted as prime causes for the shortages. With correction of out-dated procedures and policies, costs moved gradually back into standard.

Table 2: Control limit factors

Values for each range	Control limit factors for the plotting of: Individual values	Successive average	Range of variation
	Factors F_i	Factors F_a	Factors F_v
2	1.8	1.25	2.51
3	1.3	0.68	2.05
4	1.0	0.49	1.75
5	0.7	0.37	1.74
6	0.6	0.32	1.67
8	0.5	0.25	1.57
10	0.4	0.20	1.52

These factors will result in a 95 percent confidence level based on a normal (bell-shaped) distribution of variables. This table is adopted from the American Society for Testing and Materials, Manual on Quality Control of Materials, (Philadelphia, 1951, page 115).

Table 3: Machine efficiency



Group	A	B	C	D	E	F		
Weekly efficiency, % Feb. 7	0	+3	−2	−2	−1	+2		
14	−1	+1	−5	−2	+1	+2		
21	−1	+3	−1	−1	+1	+1		
28	0	+1	−4	−1	−1	+1		
Total	−2	+8	−12	−6	0	+6	Total	Average
Average	−.5	+2	−3	−1.5	0	+1.5	↓	↓
Range	1	2	4	1	2	1	11	2

Although both machines C and D are below the control limit for average efficiency, machine C is also showing a variability outside the acceptable range. This double indication may help to pinpoint the cause of machine C's poor performance.

Data parsimony . . .
(continued)

This example highlights the need for concern not just with high but with unduly low costs. In this instance, they signified hidden losses. At other times they may point to faulty recording of source information or improper data processing.

Keeping machines in line

In some cases control limits may be set up for more than one factor. For example, in a machine shop, the management may be interested in both the efficiency of each machine and the range of operating performance. Let's assemble a group of five machines.

For each machine (Table 3 on page 29) the efficiency values are expressed as deviations from standard output. The range of efficiency for each of four values is the difference between highest and lowest efficiency. Machine *B*, for example, has a range of 3 - 1 = 2. The average range of all groups is 2. From the table of limit factors the lower control limit for average 4-weekly efficiency is:

control limit = goal — (average range) x F_a
= 0 - (2 x 0.49) = 1.0

The upper control limit is obviously of no concern. However, the control limit for the range of variability is:

control limit = (average range) x F_v
=2 x 1.75 = 3.0.

In table 3 (page 29) only *C* has exceeded the range limits. Undoubtedly, the low average efficiency is at least in part caused by the high variability in performance. This provides a plausible clue for corrective action: check into the variability in group *C*.

Pointing out production needs

Production control is an almost-perfect situation for control chart techniques. Consider a firm that required heavy inventory build-ups during the off-season so as to be able to supply demand during peak season. Because of poor forecasting techniques, the sales department keeps on changing the anticipated volume, thus causing high costs and inefficiencies for changes in set-ups, dies, fixturing, assembly-lines, and finishing formulas in the various production departments. A system was worked out whereby the past four years' sales experience, as a percent of total sales, would serve as the typical pattern of sales build-up for a season. Next, past variability was used to establish control limits. It was agreed that no changes in inventory build-up or production schedules would be made unless the current trend of sales went outside the upper or lower control limits. After some trials and adjustments, the system eventually worked to the satisfaction of all concerned. The control chart took the form of a cumulative, typical sales build-up pattern with the control limits (see chart). Actual sales, when they exceeded the upper limit, signaled the need for increased production. Charts were maintained for 50 product styles, but only the out-of-control conditions were reported.

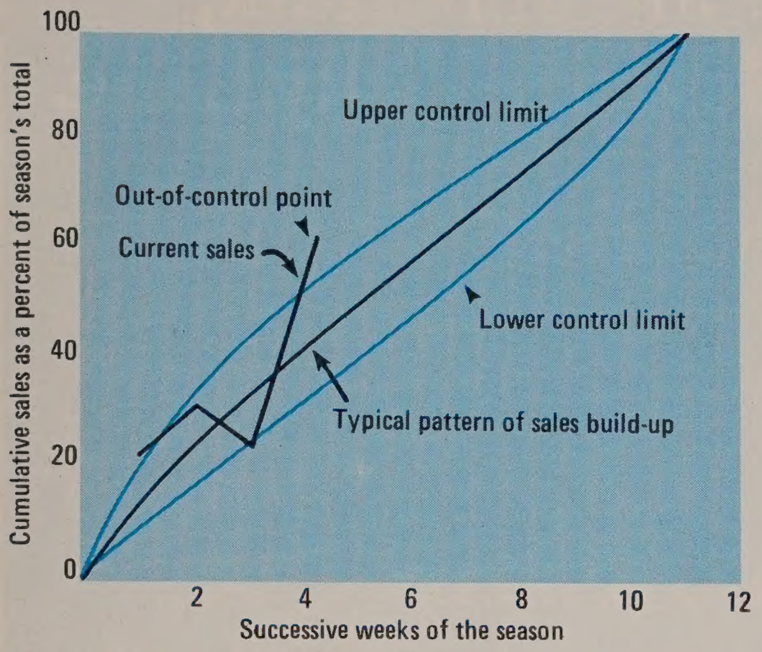
To set up the chart, the weekly sales for four years is tabulated (see Table 4). This past experience is then converted to percentages of total sales, thus making the years comparable. From the total and average cumulative sales, the typical weekly pattern of sales

Table 4: Sales data

Week	Weekly sales				Cumulative sales				Cumulative sales as a percent of the season's total sales								
	'66	'67	'68	'69	'66	'67	'68	'69	'66	'67	'68	'69	Total	Average (rounded)	Range	Control limits	
																Upper	Lower
1	11	18	29	8	11	18	29	8	2	3	3	1	9	2	2	4	0
2	16	30	29	17	27	48	58	25	5	8	6	3	22	6	4	10	2
3	16	42	28	35	43	90	86	60	8	15	9	7	39	10	6	16	4
4	33	66	29	24	76	156	115	84	14	26	12	10	62	15	7	22	8
5	32	48	77	50	108	204	192	134	20	34	20	16	90	22	10	32	12
6	76	48	96	67	184	252	288	201	34	42	30	24	130	32	12	44	20
7	75	84	134	101	259	336	422	302	48	56	44	36	184	46	16	62	30
8	87	72	154	118	346	408	576	420	64	68	60	50	242	60	14	74	46
9	86	72	134	168	432	480	710	588	80	80	74	70	304	76	10	86	66
10	32	48	154	151	464	528	864	739	86	88	90	88	352	88	8	96	80
11	54	60	57	51	518	588	921	790	96	98	96	94	384	96	4	100	92
12	22	12	39	50	540	600	960	840	100	100	100	100	400	100	2	102	98
Total	540	600	960	840													
Average	45	50	80	70													

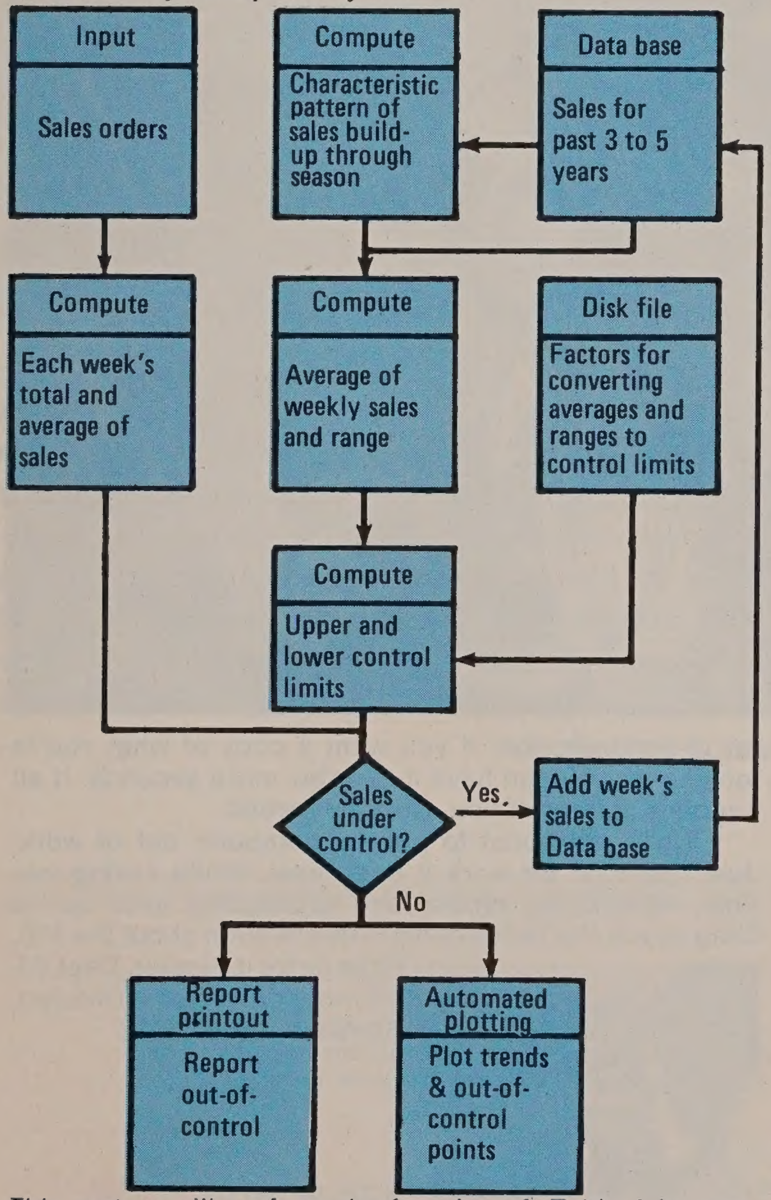
Control limits need not be fixed, as this table shows for a weekly sales build-up over a season. Here the range of the limits is low at either end of the period, indicating a need to keep a close watch on the sales figures.

Cumulative sales chart



A cumulative sales chart can show when sales build up sufficiently to require an increase in manufacture or fall enough to warrant a cutback. Detailed reports are only issued when the sales exceed a limit.

A control-by-exception system


Input
Sales orders
Compute
Characteristic pattern of sales build-up through season
Data base
Sales for past 3 to 5 years
Compute
Each week's total and average of sales
Compute
Average of weekly sales and range
Disk file
Factors for converting averages and ranges to control limits
Compute
Upper and lower control limits
Sales under control?
Yes
Add week's sales to Data base
No
Report printout
Report out-of-control
Automated plotting
Plot trends & out-of-control points

This system will perform the function of Table 4 in comparing the actual sales with the characteristic pattern derived from the previous four years' sales. When an out-of-control situation occurs, the system will print out a suitable report and, if required, a trend chart.

build-up is obtained. Next, the range based on the highest and lowest cumulative sales value per week indicates past patterns of variability (which are expected also to prevail in the coming year). With four values per range, the control limit factor F_i is 0.1. The goal value for control charting is the past typical pattern average. The formula thus becomes:

control limits = average ± range x F_i.

For week 1:

control limits = 2 = (2 x 1.0) = 4 and 0.

For the second week, the limits are:

6 ± (4 x 1.0) = 10 and 2.

The use of past averages does not affect the adoption of a higher absolute goal for this year as against last year. For example, 50 units may have been 20 percent of the total in a given week of last year (with 250 as the total). But 80 units may be 20 percent of a total of 400 predicted for the coming season. The absolute sales volume is forecast from past trend projections and other methods involving quantitative evaluation and qualitative judgement of the market.

Implementing exception reporting

Exception reporting can be readily translated into computer programs (see chart). In the previous production-sales coordination application the following major steps are involved:

- From existing data banks (sometimes modifications and enlargements may be needed), records of sales and sales orders will be on hand for the past several years. It is then a simple matter to compute the subsequent cumulative sales representing the characteristic sales build-up pattern for the coming season. Averages and ranges are similarly computed by simple routines.
- The conversion factors to obtain the control limits from averages and measures of variability, are stored in the computer (using conversion factors, Table 1).
- Provision is next made to enter current bookings of sales and sales orders. Comparison of actual sales against typical patterns and control limits then leads to identification of *in control* or *out-of-control* conditions.
- When an off-standard condition occurs, it may be reported to management as either a simple print-out with details of the nature of the problem or as both a print-out and an automatically prepared control chart.

The system is applicable to all major products or product groups, depending on the degree of detail of control that is to be accomplished. While preferences and emphasis on philosophy and procedures of control will vary, the systems flow chart provides a basic framework from which modifications can be developed as desired. ☐

Until recently, Dr. Norbert Enrick was a full-time consultant concerned with applications of management-science systems. Currently, he is professor of management at Kent State University. The material in this article is slated to be included, later in the year, in his next book, **Decision-Oriented Statistics,** (Brandon/Systems Press).

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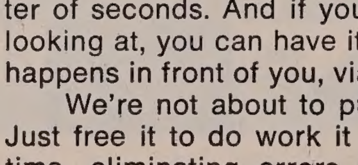

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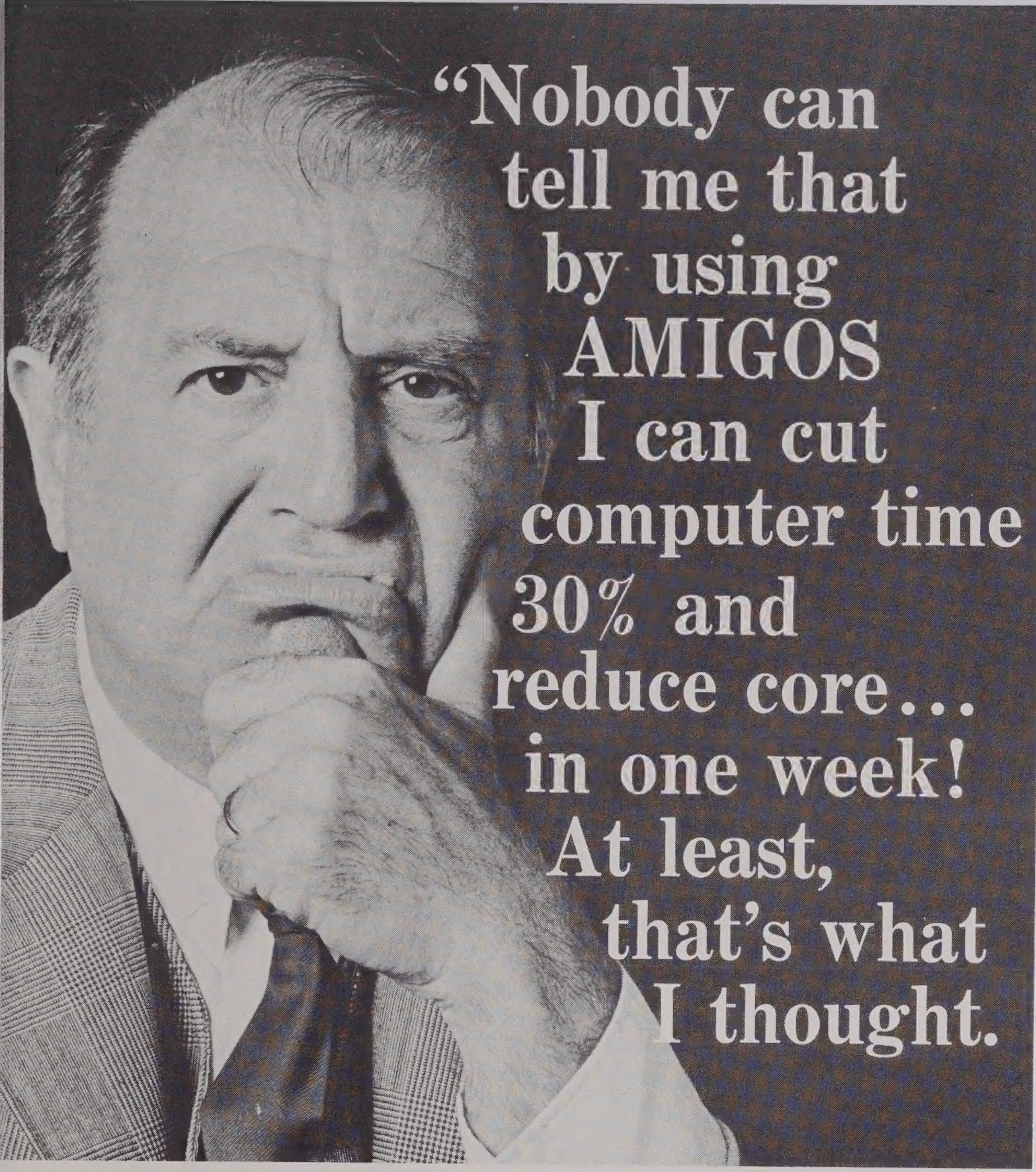
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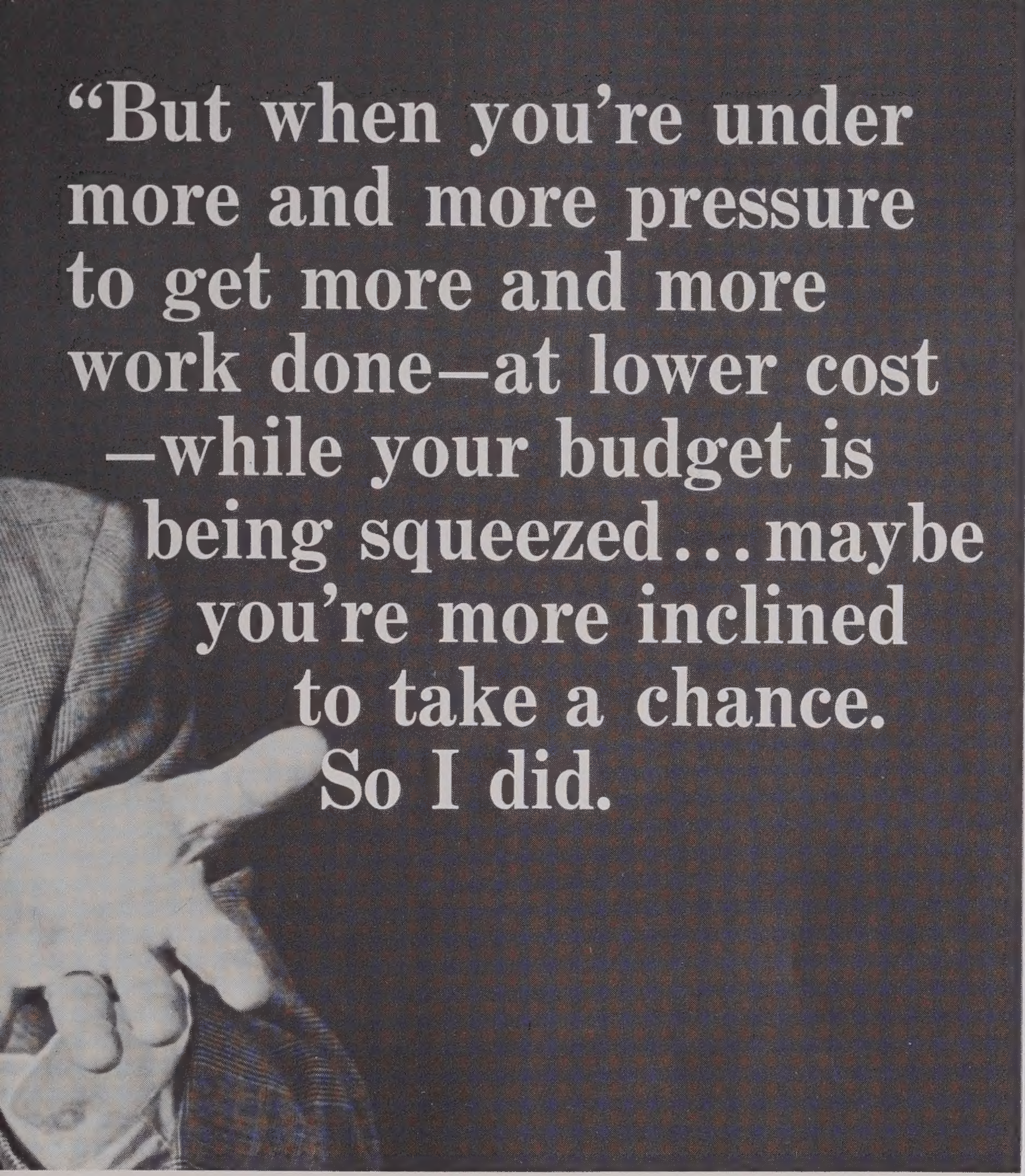
reduce core...
in one week!
At least,
that's what
I thought.

Pardon me if I consider myself an expert on computer systems, and especially the IBM 360. I've been in the computer game for years, used the 360 ever since it was introduced. I use them every day — at least my people do. When the man from Comress told me I could cut time and costs, I just couldn't believe it. Especially when other good men had tried, and failed. But then he told me about a new file accessing technique — AMIGOS — that replaces my computer manufacturer's ISAM — my biggest single time-consumer!

The man from Comress told me AMIGOS is easy to install, avoids major file conversion, and involves only minimum cost and personnel time. He said it's simple to replace ISAM. All I had to do was to change my COBOL programs to use AMIGOS linkages and convert my files to AMIGOS formats . . . and Comress supplied programs to do it automatically! And if I had used BAL, he was prepared to help me as well. I've heard these stories before. But I decided I had nothing to lose. If it was good, I was ready to take advantage of a good thing, Maybe I could show *him* something.



“But when you’re under more and more pressure to get more and more work done—at lower cost —while your budget is being squeezed... maybe you’re more inclined to take a chance. So I did.

He said I could eliminate ISAM from my system. But I’d be crazy to cut loose from the old program to try out a new one. So he said I could keep ISAM if I wanted to, for conversion purposes, or any other reasons (I didn’t tell him what my other reason was!) He said I could use AMIGOS for my time consuming programs and ISAM for the others, and everything would work fine. So I told him to go ahead and show me.

It wasn't until afterward that I learned that the Comress design team members who developed AMIGOS each had worked on IBM 360 software development for five years. So they knew their system and software.

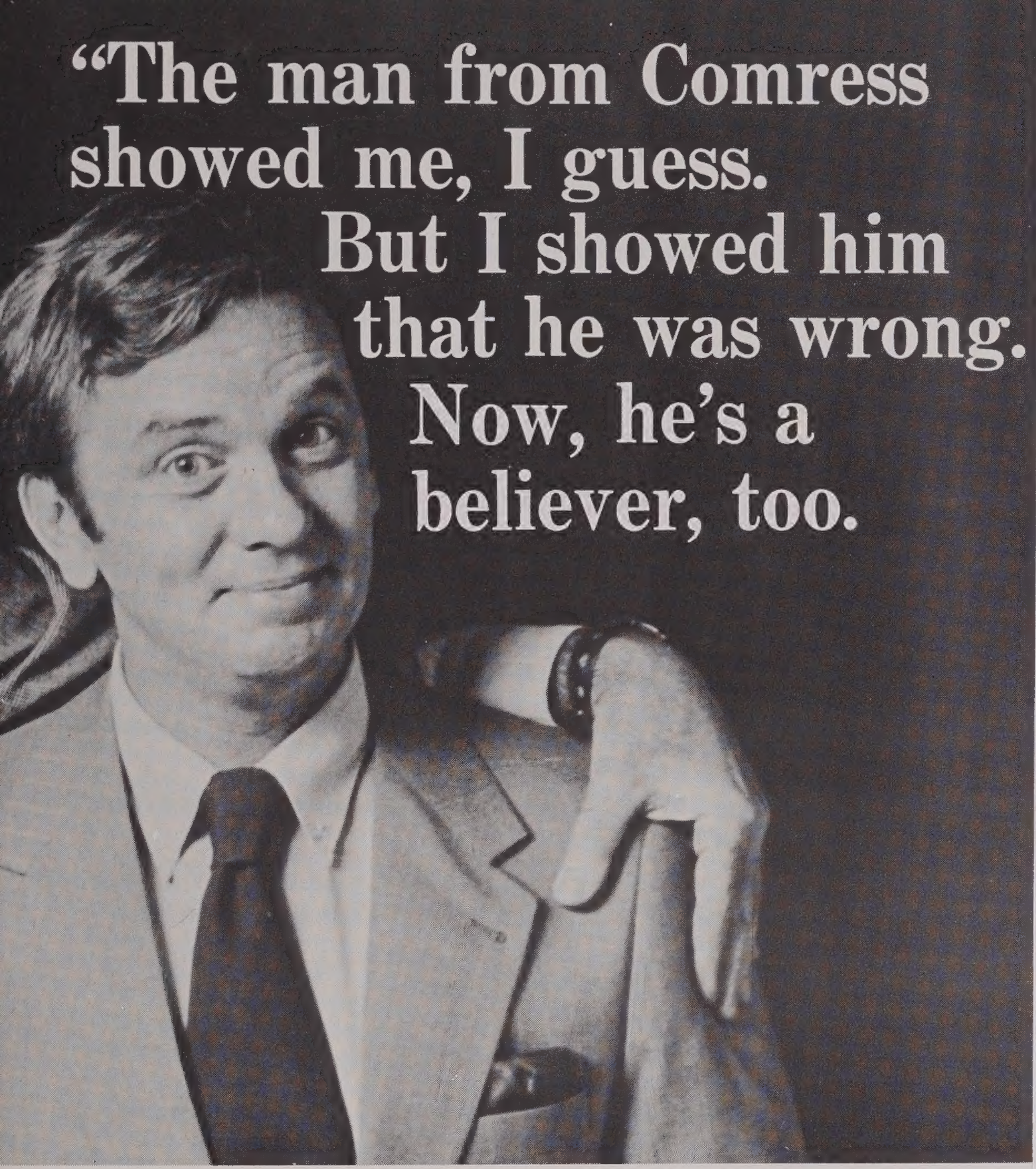
He told me AMIGOS is a tighter program, more efficiently written, and uses true third generation design techniques. It eliminates the major weaknesses of the indexed sequential accessing methods written five years ago.

"Sure I told the man from Comress to go ahead and show me. But I told him if he didn't meet his minimum commitments for AMIGOS... he's had it!

It wasn't just the improvements in performance that AMIGOS tried to prove to me. The man from Comress talked new features too. COBOL programs where you can intermix random and sequential processing of the same file with AMIGOS without frequent openings and closings. Its files are really multi-purpose. Or secondary allocation so you don't have to reserve lots of extra disc space if you guess wrong. Or generic searches by COBOL programs — something you could never do before. I listened. And I really started hoping he could deliver.

In spite of what I showed him, he still goes around telling people that they'll get only 30% less processing time with AMIGOS — while I'm getting 50% less!

I really took that guy to the cleaners. Sure, he told me about one guy who cut running time 50%, when all he promised me was at least 30% less running time. I'm getting so many savings in so many ways—on the big programs. I'm saving a lot more than 40,000 bytes he said was tops in savings. Disc space is much less than the 80% of previous space I needed.



"The man from Comress showed me, I guess. But I showed him that he was wrong. Now, he's a believer, too.

See, I'm the kind of manager who is less interested in what a salesman claims than in the way I can show him how I capitalize on the product he sells me. Of course, most 360 users might not have the experience and know-how that I have — well, that my staff has. Maybe that's the reason Comress is so conservative in making claims. They realize these advantages over ISAM can result in varying benefits for each user on his own system. So they just tell you the minimum they will guarantee.

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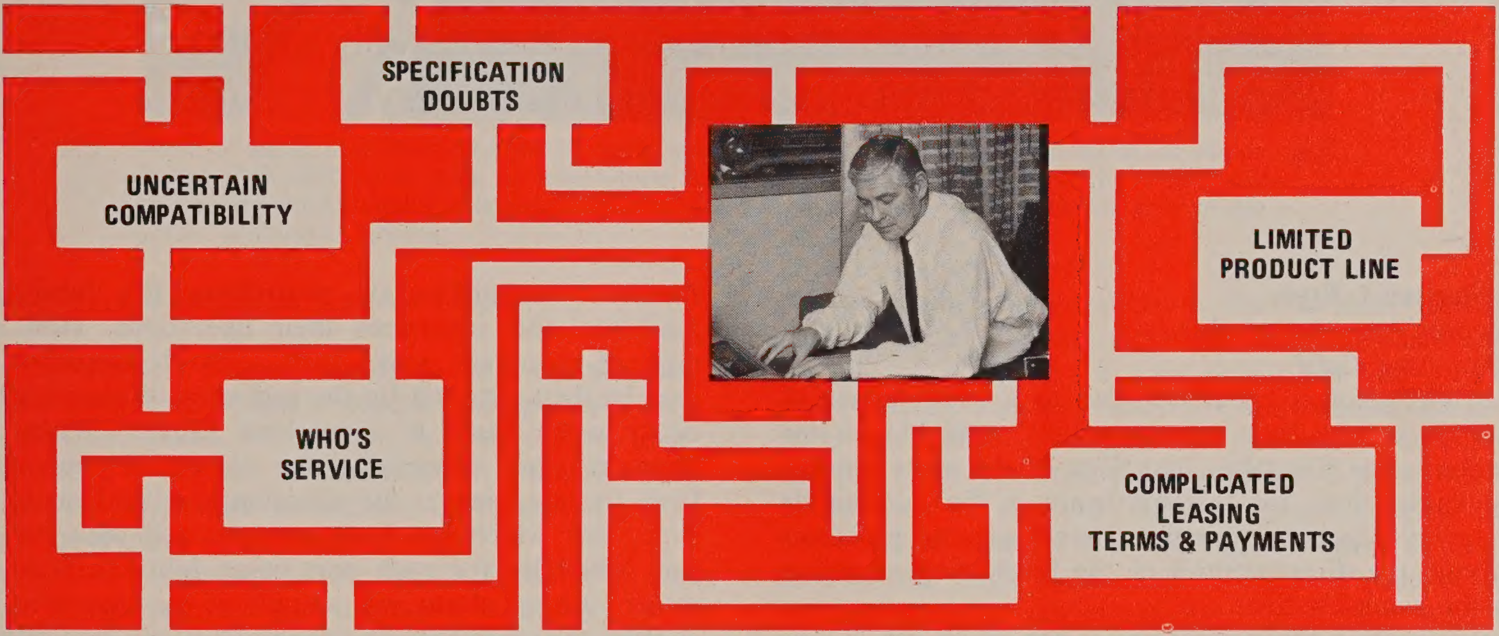

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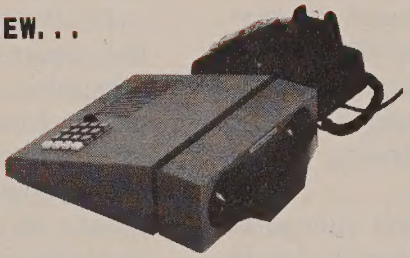

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INFORMATION RETRIEVAL NUMBER 9

Minicomputers speed automation on the factory floor

The ubiquitous mini has found its way to the assembly line where it is being used extensively for the efficient control of fabricating machinery.

by Stephen J. Fryer
General Automation, Inc.
Santa Ana, Calif.

Minicomputers have been put to a wide variety of uses since they first became readily available on the market some five years ago. One of the most promising applications for this hardware is the automating of highly repetitive, complex manufacturing processes through the direct control of the fabricating machines on the assembly line.

Automating these processes is not, of course, a new development—automated fabricating machines using hard-wired logic to control their movements have been around for quite some time. However, minicomputer control can offer users significant advantages over hard-wired logic. The first and foremost of these advantages is flexibility. For example, after loading the applicable program, variables can be changed by keyboard request so that the mini-controlled fabricating machine can perform different jobs or accommodate different patterns (such as drilling a different sized hole within the same job classification, or winding a coil with a smaller- or larger-gauge wire).

If hard-wired controllers were used, each change in job or pattern would require a corresponding change in the hard-wired logic—a time consuming and expensive process. Minicomputers are also capable of controlling more than one machine. Generally, one hard-wired controller is required for each fabricating machine. Using small minicomputers, however, we have installed systems where up to 16 different machines are being controlled by one computer. The minicomputer gives repetitive accuracy and can take corrective action when an out-of-tolerance situation arises. Finally, the minicomputer offers decreased maintenance costs compared with a conventional hard-wired controller, especially when the controller uses significant numbers of electromechanical relays.

Putting the mini to work

The coming configuration for minicomputers and fabricating machines on the factory floor is the so-called "distributed computer concept." In this configuration, each minicomputer is linked to a larger, supervisory computer within the factory area. This larger computer provides storage and back-up for the smaller "worker" minis controlling the fabricating machines and supervises their operations. How this type of automatic supervisory control functions can best be demonstrated by the sequence of events which occur when there is a machine failure. When this happens, data concerning the failure is transmitted from the machine to the minicomputer and on to the supervisor which has been programmed with production schedules for each part being fabricated. At the same time an alarm will sound on the assembly line alerting the operator. The supervisor will then consult its pre-programmed schedules, and notify another mini down the line that it may have to do more work. This second mini will then notify its operator so that whatever mechanical changes are required (for example inserting a larger coil of wire in the fabricating machine) can be carried out.

On the factory floor, then, minis serve two functions: they control the operations of the fabricating machines themselves, and they provide and receive information on machine status for the benefit of the human operators. These control and information functions are grouped into a hierarchy that can be looked at as the analog of a typical corporate hierarchy: At the lowest level (the assembly line) control is on the same basis—the human operators are concerned with only one (or possibly two) machines. At the supervisory computer level, where management of many computers is being carried out, control involves several minicomputers (and several machines). The information provided by the supervisory computer concerns more general items such as schedules and analysis of machine breakdowns and production rates.

While the distributed computer concept is the most common configuration, it is by no means the only one. Some applications (such as component insertion on a printed-circuit-board assembly line) may require only a "stand alone" worker minicomputer. This type of setup may be sufficient if the mini is required only to control the fabricating machine. If, however, both control and information are required, a larger stand-alone mini may be set up in a "worker-supervisor" configuration. In this case, the one machine would provide both functions—controlling the fabricating machine and providing management with information. Growth into a fully distributed system can occur later if needed.

Minis at work: At a Western Electric plant, minicomputers control the activities of machines used in the manufacture of coils for touch-tone dialing switches. The eight-by-eight matrix plate containing plastic shells upon which the coils are wound is shown below; above, four of the actual winding machines.

Controlling production at Western Electric

Minicomputers are particularly suited for controlling the manufacturing of small, complex components such as electronic parts where tight tolerances are commonplace. For example, Western Electric uses them to control the large-scale production of switches used in touchtone dialing.

A critical component in the switch is the coil, consisting of two primary and secondary windings. These windings are made on plastic shells—about two inches long—which extend on both sides of an eight-by-eight matrix plate, as shown above. The computer's job is to control the actions of three pulse motors. Two drive the *x* and *y* axes of the table on the winding machine so that the proper matrix is positioned under the winding head. The third motor controls the *z* axis as the actual windings are made on the coil. An encoder on this motor reads 512 pulses for every complete wind of the coil. The wire itself is 0.020 inches in diameter.

The problem of controlling this machine, is of course, a problem in responding to the 512 pulses and raising the table 0.020 inches so that the next wind can be made. Additionally, the coil must be wound in a continuous helix to avoid overlapping. In the case of the hard-wired machinery formerly used by WE, the response rate was limited to about 1/1000 of a minute (60 milliseconds), with the result that the *z*-axis motor jumped 0.020 inches each 512 pulses. Because the *z*-axis moved abruptly, about 10 percent of the coils were rejected for overlapping windings. To cut down this rejection rate, WE installed 4k computers to act as controllers, replacing the hard-wired logic. These computers were able to respond 20,000 times per minute or once every three milliseconds, 20 times faster than the hard-wired logic. This allowed the computer to take advantage of 0.001-inch movement per pulse of the *z*-axis motor. In operation, the computers averaged the pulses out so that output to the *z*-axis motor occurred every 25.6 pulses and each winding step was made in increments of 0.001 inches (20 times per revolution) instead of 0.020 inches. The substitution of minicomputers for the hard-wired logic formerly used effectively brought the 10-percent rejection rate down to zero.

The actual configuration at the Western Electric plant consists of some eight winding machines, each capable of handling 16 coils (eight per side of the matrix plate). The minis used for this purpose are SPC-12's, each with a Teletype for operator intervention and print-out. The supervisor computer is also an SPC-12 with a disk attached. This supervisor oversees the operation of each of the winding machines by using data on the day's production schedule. If one of the winding machines (or one of the 16 coil winders) fails because of a jammed wire or a similar problem, the supervisor takes it off-line, notifies the operator on the assembly line as to what the problem is, and increases production on another one of the machines. In addition to handling the chores of supervising the coil winders, this computer also controls a series of minicomputer-controlled wire-wrapping machines.

Programming the system

The actual programming of this system took place in several stages. The first stage was the writing of the overall systems specifications. These specifications included the definition of the finished product thus providing the criteria around which the system had to be developed and implemented. Additional information was then obtained on the design specifications of the machines. This covered such things as the start-up and overrun characteristics of the motors (how long it takes to get one running at full speed; how long it takes to stop). Other constants also defined the table upon which the fixture would be mounted. This mass was expressed in terms of how many milliseconds it would take to stop the table when the *z*-axis motor stopped. Top and bottom limits were initially established for this constant; later, when the system was up, the constants were tuned to reflect actual operating conditions. About 50 such variables defining the actual production machinery were set up. Error routines were also created, consisting mainly of exceptions when excessive table motion occurred. For example, an error occurred if the *x* and *y* axes moved more than 18 inches, or if the *z* axis moved more than 1.125 inches. WE required eight different applications programs each capable of winding coils according to eight different patterns. We had to set up the selectable operating requirements at this point involving such things as the number of winds, the primary to secondary winding ratios, etc. Variables were also set up to allow operator selection of patterns and winding machines.

Minis speed aircraft production

The use of minicomputers in assembly-line applications is not, of course, limited solely to the production of electronic components. Grumman Aircraft, Bethpage, Long Island, New York, is using them to control the close-tolerance riveting of aircraft wing panels. In this case the rivets used are made of titanium, and require a controlled time/pressure function in their application. Using exotic metals such as this requires a great deal of care—a rivet that is formed too rapidly can easily become brittle.

Before minicomputers were used, machine riveting was accomplished by regulating the motion rate of anvils and the formed dimension of each individual rivet. This type of control was adequate as long as the rivets were the same—that is, the same type, shape and size, and were used to join the same thicknesses of materials. Usually, however, these parameters change constantly, resulting in the need for logic—either human or electronic controllers. To get around this problem the company devised a new concept in machine riveting using a minicomputer, which enabled them to regulate the anvils' force rates—rather than the movements rates—and the formed dimensions of the rivets.

The riveting system itself consists of a 16-by-16 foot center section where the riveting is actually done. Projecting from each side of this section are 45-foot-long workpiece carriage beds. The location to be riveted is positioned in the center section where it is drilled, deburred and coated with a sealant. A proper rivet is then selected and dropped into the hole. When the rivet is in the proper position, the anvils close and flare it. The heart of this system is a 12k minicomputer, which commands and controls all these functions. In operation, it handles the preliminary steps of positioning the workpiece (the wing panels) in the proper *x-y* positions for each of the assembly and fabrication procedures, and positions the anvils so that their centerlines are normal for the piece being worked on.

In initial assembly operations, seven different types of rivets are used. The control system must first note the different forces required to flare each rivet, and must know the various forces to be applied to different rivet head styles—even though they may have the same body diameter. A further complicating factor in the process is the fact that the force/time curve for any given rivet style and size is not linear—the control system must vary the anvil force as a function of time measured in milliseconds. Located on the actual riveting machine are position transducers and end-of-operation indicators. These feed signals through an interface to the computer's input/output section. Another interface unit enables the minicomputer to output driver signals for the workpiece carriage and functional actuators. A Teletype is used to signal start and stop operations; the Teletype's paper-tape reader is used to load the mini-computer programs.

Things get moving when the minicomputer—loaded with the proper program receives a Teletype signal to start the operation. First off, the program maneuvers the workpiece into proper position and then causes probes to determine if the centerline of the work is normal to the workpiece surface. Next, the working tools — drills, deburrer, sealant applicator, rivet loader and anvils—are correctly adjusted and given the signal to go. When forming a rivet, the computer monitors its clock in relationship to the force cell outputs from the anvils, making any necessary adjustments to keep the force/time curve within prescribed limits. At the same time, if a signal shows up on a workpiece load cell, the anvils are moved as a unit so as not to disturb the squeezing force between them.

In this system, the operator can get a printout of pertinent data as operations progress by simply keying an appropriate code on the Teletype. Such information includes rivet position, force/time relationship, work centerline adjustments and finished rivet length. The operator can select certain portions of the complete fabrication for analysis or he can call for data on the whole assembly. In using a minicomputer in the riveting process, certain advantages became quite apparent. In the first place, the cost was far less than the equivalent hard-wired circuits. Furthermore, the minicomputer controller system has almost unlimited flexibility—inexpensive software changes can accommodate almost any changes in the performance of a machine.

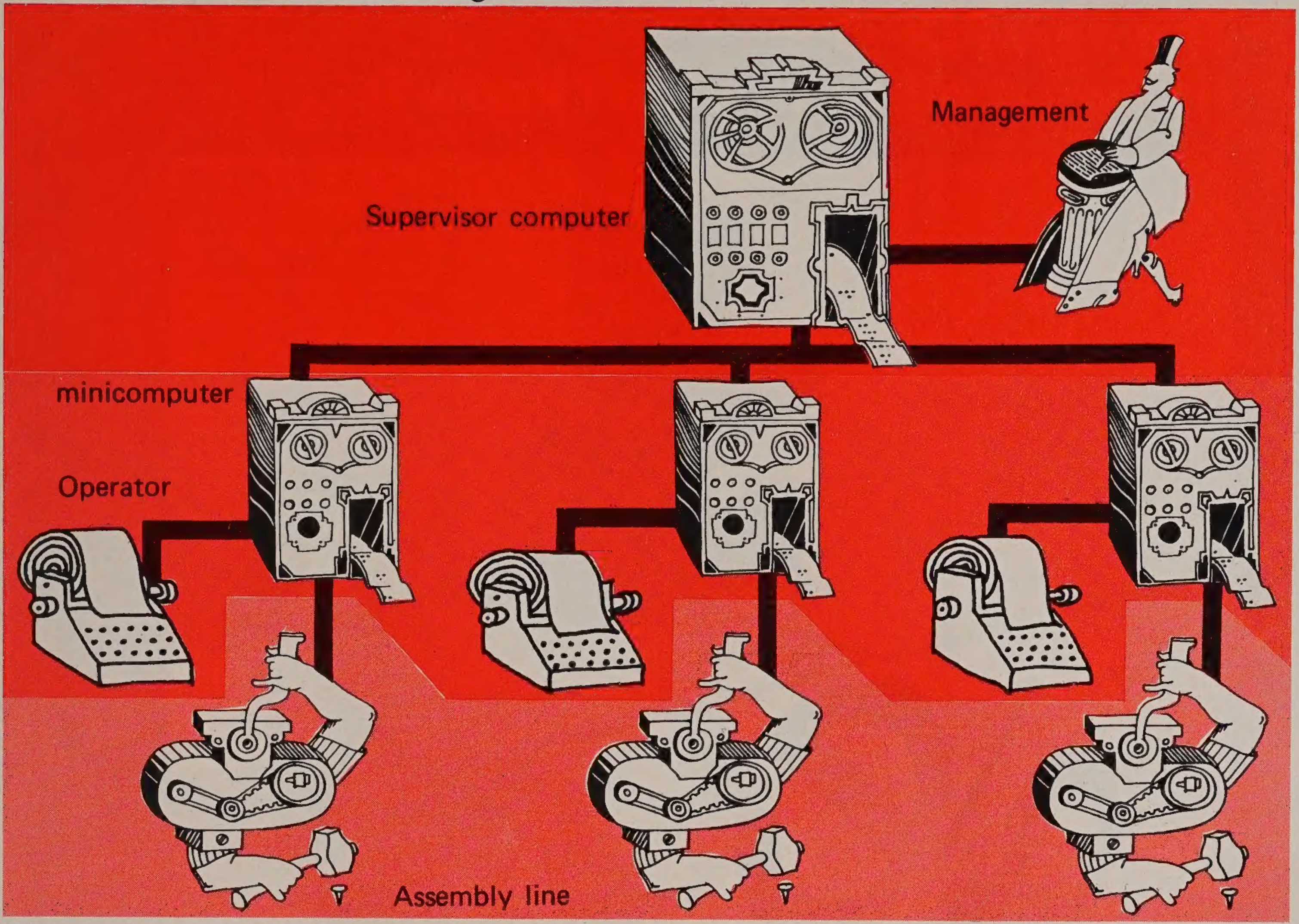
What does it all cost?

These two applications serve to illustrate how minicomputers can be put to work in repetitive assembly procedures marked principally by a need for automation, and by high speed and a high degree of accuracy. Putting minicomputers to work in these areas, of course, requires a careful study of the individual application. Costs will also vary per application, but an idea of what they are may be gained by a study of the installation at Western Electric.

The work was done by us on a fixed-fee basis and was broken down into four steps: First, there was what might be called a "definition stage" in which we went in and defined WE's coil-winding system as it was, and made a determination of whether automation by computer was feasible. This involved determining speed requirements, available equipment and tolerance specifications on the finished product. Work in this phase including writing the outline specifications, estimating the costs and projecting the programming effort involved. Time here was between two and three man-weeks at $1,000 per man week.

The second stage of our installation involved the creation of detailed specifications of the project. Work here was basically defining how we were going to automate the winding process with minicomputers, creating a detailed systems analysis study and pinpointing the price of the system. Time expended in this phase was approximately two man-weeks. Once we had these definitions in hand, we were able to proceed with the actual construction of the system. The first step was a detailed flowcharting of the assembly logic and programming.

Minicomputer control of fabricating machines



When used to control fabricating machines on the assembly line, minicomputers will increasingly be configured in the "distributed computer concept," as shown above. In this configuration, each "worker" minicomputer on the assembly line is interfaced to a fabricating machine, providing control of the machine's movement, and information on its operating status for the machine's operator. This information is sent to the supervisor computer which also controls the activities of the "worker" minis on the line, and provides overall information for higher-level management.

About three man-weeks were required to flowchart the logic and set up all the tables and variables that would be required for the application. We then began actually coding the applications programs. These programs consisted of an executive for timing and response to operator commands; *x*, *y* and *z* drivers; a wind driver; start and stop detects; high-speed and low-speed wind checks (these control the number of winds and determine when it is necessary to slow down the *z*-axis motor); an auto restart, and an operator request program. Coding and debugging of these programs required about five man weeks.

Hardware implementation was carried out concurrently with our software development. First on the list was quality control at our own factory before shipment. This included subjecting the equipment to environmental tests, hooking up the input-output interfacing, and running a system check. Last step was to load in and test the software. Total effort here was about two man weeks. We then went through a system simulation using Western Electric control equipment for dynamic system tests. For this particular system we did not run a computer simulation model since the equipment to be automated was easily movable and could be hooked up for testing. Finally, there was a total one-time system charge of about $12,000.

Actual installation of the system at Western Electric consumed about two man-weeks, and after several dummy runs, the computers were put to work controlling the winding machines. Our total time spent from the day we started looking at WE's automation needs until the day the first computer was controlling a winding machine was about four months. Total cost: about $45,000. Additional units could be produced at a lower cost since the programming effort would not have to be repeated. Service for the system is on an "on-call" basis, and is about one man day per month. ☐

Steve Fryer, district manager for General Automation's Los Angeles sales area, is a mechanical engineering graduate of the University of Southern California. Before joining GA, he was a programming analyst and later a sales and applications engineer at General Electric's Process Computer Section in Phoenix, Arizona.

The new PDP-8/e:
Its own mother wouldn't know it.

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CAUTION FRAGILE

The PDP-8/e is a radical departure in computer design. There's no back panel wiring—everything plugs into the OMNIBUS,™ even the CPU. In any order. It's completely flexible; you buy only what you need. And if you need more later, just buy it and plug it in. And the PDP-8/e is easier to interface and easier to maintain than old-style computers.

We've made a few other changes. Easier programming. 1.2 μ sec memory cycle time. 15 added instructions. 256 words of read-only memory. 256 words of read/write memory.

Yet there's no generation gap between the PDP-8/e and the rest of the PDP-8 family computers in 7500 world-wide installations. They all use the same peripherals (over 60 of them). They're all program and interface compatible, they all have extensive applications and documentation. PDP-8/e was born with a silver software package in its mouth.

The basic 4K machine sells for less than $5000. With teletype, less than $6500. Quantity discounts available.

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with features like these:

- realtime executive operating system
- *extensive* operations repertoire
- 16 addressable registers
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- data chaining
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it's more than a minicomputer

This powerful *mini/max** computer from Infotronics fills the gap between the minicomputers and the "big boys" but has a modest price tag. And the cost of adding peripherals is less for the *mini/max,* too. Get the full story on realtime executive and the *mini/max* by writing Infotronics, 8500 Cameron Road, Austin, Texas 78753 . . . or calling 512-454-3521.

* Trade Name of Infotronics Corp.

INFOTRONICS
CORP.

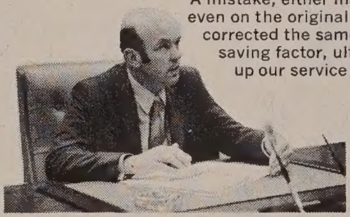
521

The incredible reducing machine is here!

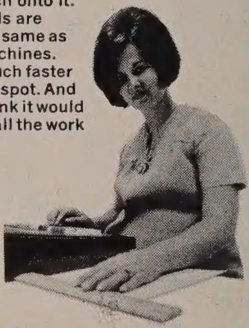
London Life Insurance Company data preparation problems reduced by KEY-EDIT —the incredible reducing machine.

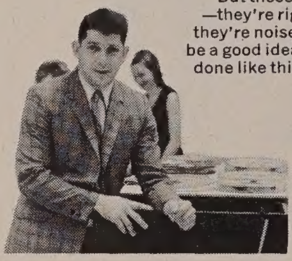
ASK them at London Life, one of Canada's leading insurance companies, how they like KEY-EDIT. They'll tell you that before they gave the Incredible Reducing Machine a trial, their operation was using roughly 23 million key punch cards a year. Next year, KEY-EDIT could reduce that number substantially. This remarkable data preparation system was installed in early April of this year. Ordinary transactions, Automatic Bank Check changes, health claims checks, and other checks that were previously coded on punched cards are now transcribed directly onto tape by KEY-EDIT, and then fed into the big computer in Computer Operations. The reaction to this sixteen keyboard installation has been most favorable for a number of reasons:

Bill Thomson, Information Systems Executive, has this to say about the KEY-EDIT system: "A mistake, either made by the key-stroker or even on the original card, will be found and corrected the same day. With this time-saving factor, ultimately this will speed up our service to policy owners."



Mrs. Linda Brown says: "I think I'll enjoy working on the system. There's less work involved for every-one and it doesn't take long to catch onto it. The keyboards are pretty much the same as the keypunch machines. But these are so much faster —they're right on the spot. And they're noiseless. I think it would be a good idea to have all the work done like this."





Larry Fazakas, Data Input & Control says: "Every year, we've had a tremendous increase in our workload resulting in more overtime for our keypunchers. We've also had a continual rapid growth in the keypunch area. We hope that with KEY-EDIT we'll slow down this growth rate and reduce the overtime work."

Nancy Foster shows the reel of computer tape that will replace the 32,000 punched cards she is sitting on. KEY-EDIT reduces floor space and costs to a minimum.

Expect more from

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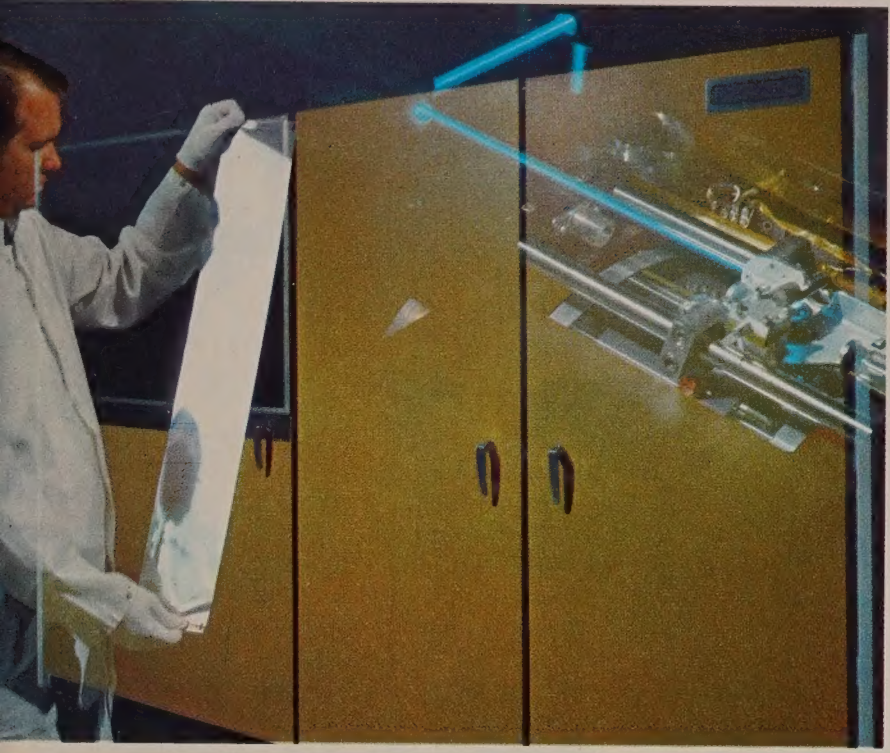
INFORMATION RETRIEVAL NUMBER 12



Laser memory offers trillion bit storage

For rapid access to very large data bases, the Unicon laser mass memory can store up to one trillion bits of data and access this data within a maximum of nine seconds. The bits are stored on coated polymer data strips by a laser beam. The system offers read-while-write verification, permanent, nondegrading records, easy updating, and selective retrieval of data based on up to 15 criteria such as: less than, greater than, key word, etc. Two separate and independent data channels are provided, and transfer rate is four megabits per second. For information retrieval, data is tracked by an optical system that will give error rates of less than one part in 10^{10}. The entire system is under the control of a Hewlett-Packard 2116B computer with disk file, magnetic tape unit, and other peripherals. For interface with any selector channel-equipped IBM 360 system or a Burroughs B6500, the system costs $1,000,000 and is delivered within one year. Other systems can be accommodated for a slightly higher price.

Precision Instrument Co., 3170 Porter Dr., Palo Alto, Calif., 94304. (415) 321-5615.

CIRCLE NO. 150

System permits digital analysis of video data

System 800 combines the color display and analysis of video signals with digital storage and processing functions. Working from a black-and-white photograph, picture elements may be added to or subtracted from elements of another picture, scaled, suppressed, correlated or statistically analyzed. The 800 can be used to analyze infrared photographs at a glance by causing subtle shades-of-grey differentiations to be displayed in highly contrasting colors. Other applications include the analysis of gravitational or magnetic fields, light intensity, thermal emission or gamma-ray dose. Programming for the system may be done in Fortran or in machine language. The system can interface with the Varian 620i and with most popular small computer systems. Images may be stored on a peripheral tape handler. Picture transfer between processor and tape takes 18 seconds. At a base price of $63,000, the System 800 can be delivered within four months. A smaller color display system without digital analysis capability is priced at $12,950.

Spatial Data Systems, Inc., 132 Aero Camino, Goleta, Calif., 93017. (805) 968-3594.

CIRCLE NO. 151

Program optimizes schedules for maximum profit

A program called "Tops" provides project managers with an advance measure of the cost impact of alternative decisions, and helps control project costs and schedules. For input, the program uses a cost-versus-elapsed-time function for each individual activity of the project. Tops then produces an optimum schedule for each activity and an interim optimal policy guide for each activity manager. This policy guide provides the managers with advice regarding the best decisions to make in the event of unforeseen problems and analyzes the cost of various alternative solutions. Tops will run on any IBM 360/40 or up with at least 32k of core or on an XDS Sigma 7. It is adaptable to other systems. Priced at $30,000, the system is installed within three months.

Hollander Associates, P.O. Box 2276, Fullerton, Calif., 92633. (714) 879-9000.

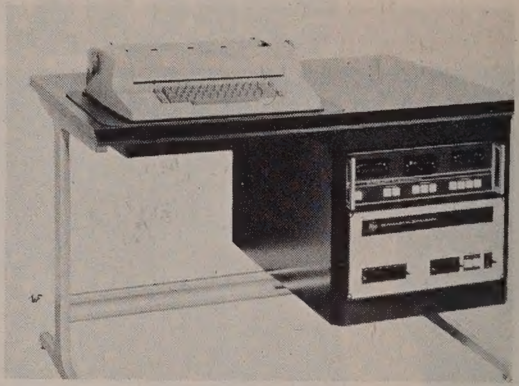
CIRCLE NO. 152

Multiprogramming system for medium-scale users

A multiprogramming system capable of running up to seven jobs concurrently is also capable of handling up to 64 active lines when run in a timesharing environment. The CDC 3170 system has a core memory expandable from 49k to 131k, 24-bit words in 16k increments. The core memory has a cycle time of 1.75 microseconds and offers indexed and indirect addressing, a priority interrupt system and a real time clock. The CDC 3170 is hardware and software compatible with the larger CDC 3300 and 3500 systems. The business data processing version directly executes variable length field instructions. The basic 3174-1 system with processor, 49k of core and two input-output channels and floating point hardware costs $614,755 or leases for $15,765 per month. Delivery is within four months.

Control Data Corp., 8100 34th Ave. So., Minneapolis, Minn. 55420. (612) 888-5555.

CIRCLE NO. 250



Programmable terminal aids remote job entry

Because the GH-500 is a free-standing programmable computer, it can become an integral working unit in a communication network, conserving central computer time and improving throughput. With the remote job entry terminal, the user can detect and correct errors at the source prior to transmission. The system includes 4k, 8-bit words of core, CPU, line printer, card reader, and communications interface. The price is $39,625; delivery is three months.

GH Computers, Inc., 280 S. Beverly Dr., Beverly Hills, Calif. 90212. (213) 278-0882.

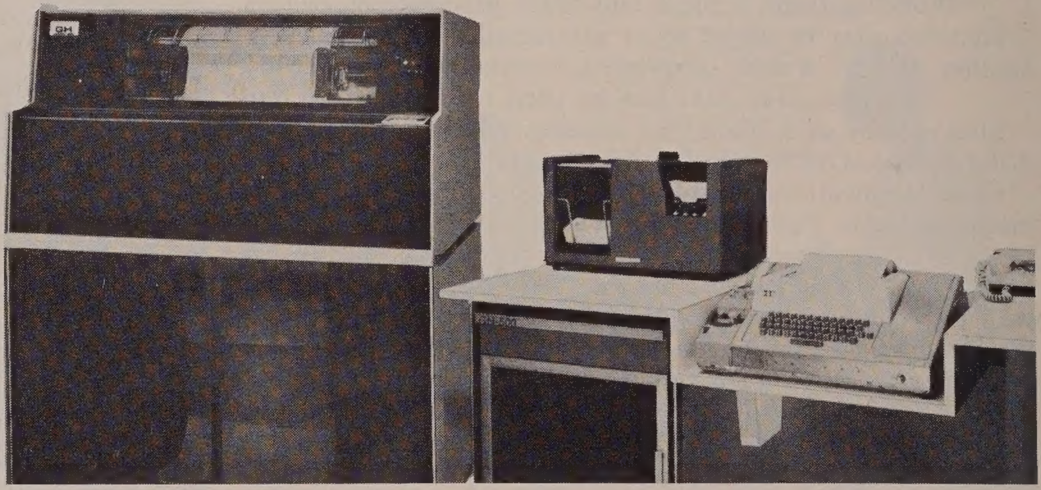
CIRCLE NO. 252

Inexpensive display system for data entry, retrieval

Designed for data entry and retrieval use with data bases, the System IV/70 is a plug-to-plug replacement for the IBM 2260 terminal system. The computer memory has a cycle time of 1.9 microsec. Memory size ranges from six to 96k bytes and word size is 24 bits. Foreground video display control package includes 2848/2260 simulator and software compatible with OS/DOS (BTAM and QTAM). A system including 32 video terminals, a 24k-byte computer, a disk drive, printer, and interface costs $62,400 with delivery in January of 1971.

Four Phase Systems, Inc., 10420 N. Tantau, Cupertino, Calif., 95014. (408) 255-0900.

CIRCLE NO. 251



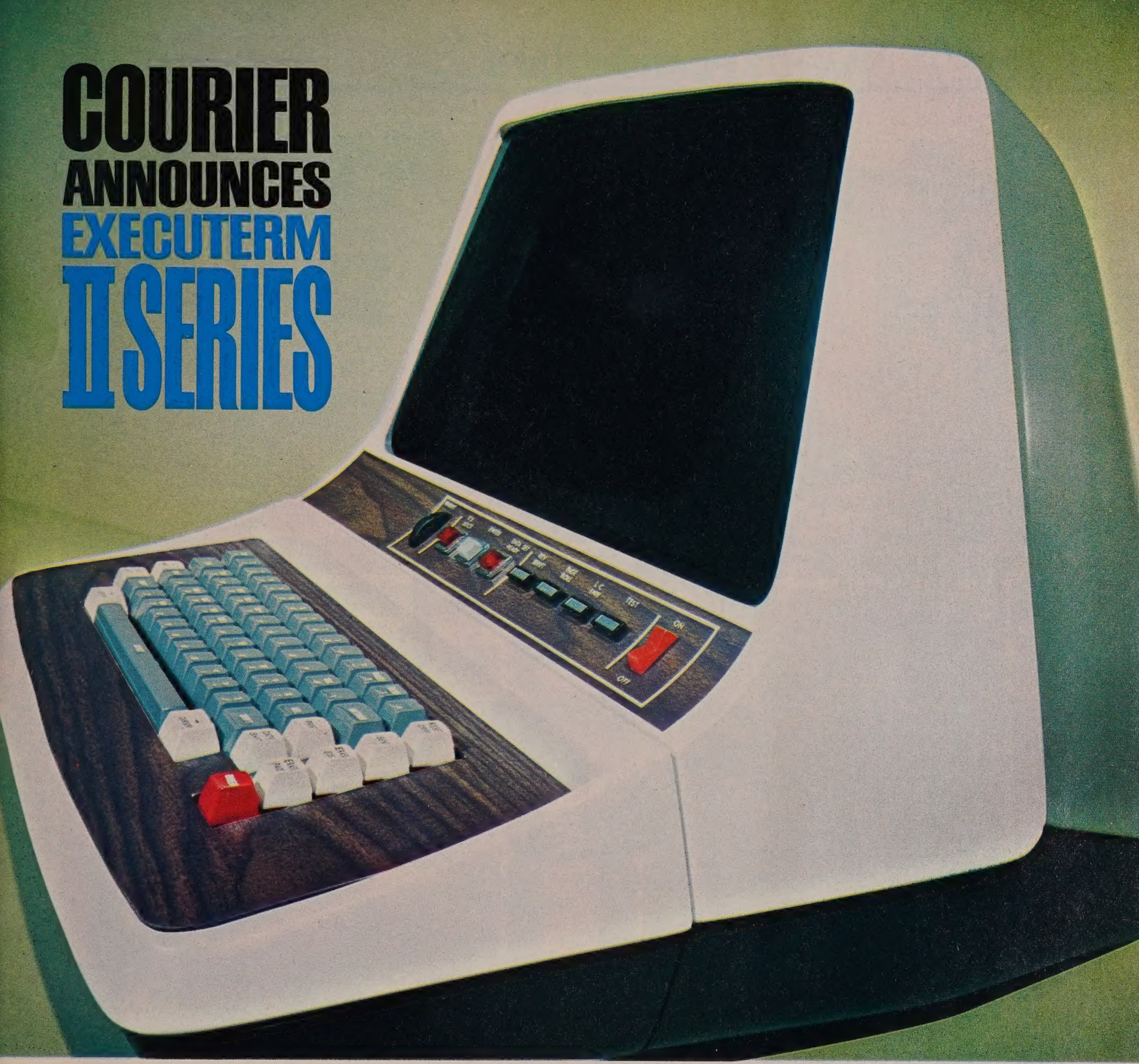
Office computer edits, corrects, formats data

As a business office computing system, Model 133 can handle payroll, inventory control, accounts receivable, general ledger and management analysis reporting. Using an IBM I/O Selectric typewriter, the operator types the data, which is simultaneously captured on cassette magnetic tape. Each cassette can store 180,000 characters. The Model 133 can turn out personalized letters with full edit, correction and format control. When combined with a Model 150 digital plotter, the system can create statistical distribution analysis, economic charting, comparative financial analysis and product performance charts. When equipped with a communications interface, the system can be timeshared by other terminals. As a multiplexer or concentrator, the unit can handle up to 75 information lines. The Model 133 can also serve as a remote data collection terminal, receiving and transmitting at rates up to 9600 bps. The system is expandable to 32k bytes (8 bit). Price of the 4k system is $22,500. Delivery is within two months.

Eldorado Electrodata Corp., 601 Chalomar Rd., Concord, Calif. 94520. (415) 686-4200.

CIRCLE NO. 253

COURIER ANNOUNCES EXECUTERM II SERIES



A new series of 80-column terminals

Courier further expands the capabilities of the Executerm Terminal line for the time sharing computer user and the IBM 360 user. Executerm Terminals provide fast, flexible computer communications for the widest number of applications, with unparalleled compatibility.

Now, the Courier *Executerm II series* adds 80-character line capability, with up to 24 lines, with *all* the features that have made the Executerm 1, 60 and 65 the *performance oriented* terminals for use in systems of any size...or for use as a single station.

Executerm II is Teletype compatible. Executerm II/60 and II/65 are IBM 360 software compatible...all with 80-character line capability. Printer options are also available.

Whatever your applications...IBM 360 or *any* mini, there is an Executerm communications oriented terminal to give you speed, accuracy and optimum computer usage time, at low cost. Write for detailed literature.

ONE STATION OR A HUNDRED...COURIER MAKES IT WORK!

Courier
Terminal Systems, Inc.

2202 East University Drive • Phoenix, Arizona 85034 • (602) 258-7271
Nationwide installation and service by RCA Service Co.

INFORMATION RETRIEVAL NUMBER 13

Multi-media terminal works on- and off-line

Offered as a $500-per-month alternative to the IBM 2770, the Model 340 batch terminal combines card reader, 132-column printer, keyboard crt display and magnetic tape cassette input-output. Users can lease the terminal with communication adaptors which emulate the IBM 2770, the ASR 33 Teletype or the IBM 1050 terminal. Also, users can upgrade the terminal from ASR 33 or 1050 codes, procedures and line speeds to 2770 codes and procedures at 1,200 baud without teleprocessing system hardware or software changes. The terminal operates with dial-up or private lines and may be configurated for off-line entry. Delivery is 90 days.

Sycor, Inc., 100 Phoenix Dr.,
Ann Arbor, Mich. 48104.
(313) 971-0900.

CIRCLE NO. 110

I/O mini controllers simplify interfacing

The Models GA-1413 and 1414 generalized input and output buffers provide parallel data communications between the company's processors and equipment using TTL-compatible logic circuitry. The units handle input or output data buffering, data buffer flagging, strobing, line driving and card addressing.
Price: $650; delivery is immediate.

General Automation, Inc.,
706 West Katella Ave., Orange, Calif.
92667. (714) 835-4804.

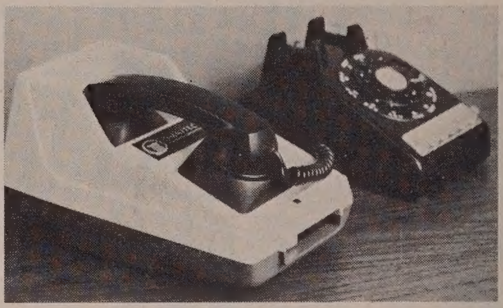
CIRCLE NO. 111

Computer entry system goes on- and off-line

Designed for on-line computer entry, the A-M Series 6000 system provides data transfer without any tape-reel handling. The system consists of a small electronic memory and control unit which is timeshared by up to six keyboard data entry and display stations. Data entered simultaneously from these multiple keyboards is stored within the memory and control unit; groups of records can be recalled for verification by any operator. Electronic keyboards closely resemble those of the conventional card punches. Data entered or called out for verification is displayed in large, illuminated letters and numerals at each keyboard station.
Prices range from $15,000-40,000; delivery is one month.

Addressograph Multigraph Corp.,
1200 Babbitt Rd., Cleveland, Ohio
44117. (216) 731-8000.

CIRCLE NO. 112



450-baud coupler offers —50 dBm sensitivity

The Model 701B telephone coupler operates at data rates of up to 450 baud with a sensitivity of −50 dBm. Standard features include dual TTY and EIA RS232 interfaces, full- or half-duplex operation and acoustic or hard-wire coupling. All electronic circuitry and the cushions, switches and connectors mount on a single printed circuit board, which can be easily removed from the case for servicing. The coupler is available off-the-shelf at a price of under $300.

Omnitec Corp., 903 N. Second St.,
Phoenix, Ariz. 85004.
(602) 258-8246.

CIRCLE NO. 113

Key-to-tape unit with read-after-write check

Stand-alone key-to-tape data station offers a read-after-write check, selective non-verification and an English display. The modular Libra 1 unit takes up the same space as a standard key-punch machine. Options include a record counter and listing accumulator.
Prices start at $8,000; delivery in six months.

International Data Sciences, Inc.,
100 Nashua Street, Providence, R. I.
02904. (401) 274-5100.

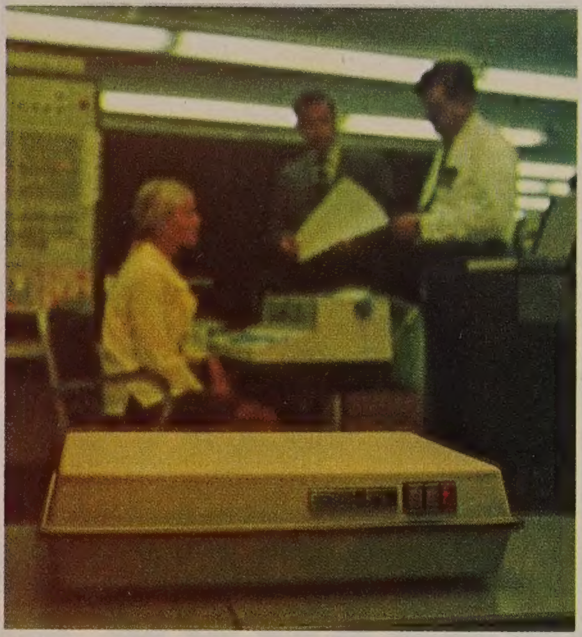
CIRCLE NO. 114

Now...a data set

without wires

optran has eliminated the need for wires in local data communication. This new transceiver/data set uses proven infrared technology in an innovative new application: point-to-point digital transmission at any data rate up to 250,000 bps. Replacing your present data sets with Optrans will eliminate the high cost and limitations of dedicated lines.

optran has overcome the obstacles to distribution network flexibility. Data can now be communicated directly over freeways, railroad tracks, boundaries between different telephone exchanges or any other surface barrier. Optran is completely portable and easily installed, and data rates are readily changeable in the field. So Optran facilitates flexibility in network configuration and terminal usage.



Hughes Aircraft Company, Fullerton, Calif., utilizes an IBM 360/65 (with a 2701 Data Adapter Unit) for the coordination of process control. Engineering staff inputs circuit parameters to the main data banks at this end. Operating at 9600 bps, the OPTRAN transmission link affords high-speed, error-free direct communication of data to Manufacturing's remote installation for development of process control specifications.

One-half mile away, Manufacturing's Interdata Model 4 uses data from the remote 360/65 to generate punched tapes for control of automatic wiring machines. Soon, this data will be used for direct control of circuit board drills, wire processors, etc. Without OPTRAN, on-line operation would be less efficient, because retransmissions due to burst errors on common carrier facilities would result in lower throughput. During OPTRAN's first two months of operation, only one bit error has been recorded.

optran has made high-speed remote terminals financially feasible. Optran is an ideal data link for putting remote job entry terminals on-line. Or interfacing computer to computer. Or providing on-line service to a combination of terminals using CTC's unique multiplex capability. And Optran pays its own low purchase price in data communication cost savings.

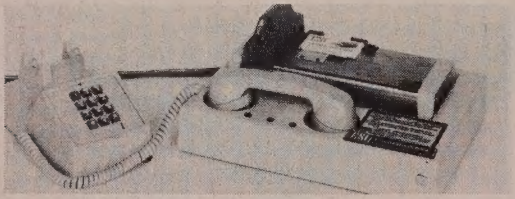
Low-Cost Local Data Distribution

CTC

For information about your specific Optran application, contact

COMPUTER TRANSMISSION CORPORATION
1508 COTNER AVENUE · LOS ANGELES, CALIFORNIA 90025 · (213) 477-5020

INFORMATION RETRIEVAL NUMBER 14



Terminal converts phones into credit centers

For as little as $7.00 per month, the Compliatone terminal converts standard touch-tone telephone equipment into a "full compliance" credit authorization center. Operating over the dial-up telephone network, the terminal assures that a sales clerk complies fully with prescribed credit-approval procedures. The store clerk dials the computer, places the handset in the terminal's acoustic coupler and indexes the account number on the touch-tone pad. The cpu accesses the customer's file and returns an audio response which activates one of three light indicators. Delivery is 90 days.

Credit Systems, Inc., Route 309 and Advance Lane, Colmar, Pa. 18915. (225) 822-3371.

CIRCLE NO. 115

CRT display boasts 68-character repertoire

Priced at $1,280 in 100-unit quantities, the Series 400 crt display offers a repertoire of 68 dot-matrix characters available in a variety of formats up to 1,536 characters per page. Available in single- or multi-station configurations, the Series 400 offers editing, page formatting and fixed-message display in a self-contained package with detachable keyboard. Delivery is 90 days.

TEC, Inc., 6700 S. Washington Ave., Eden Prairie, Minn. 55343. (612) 941-1100.

CIRCLE NO. 116

OCR reader gives small user a break

Intended for the small-scale OCR user, the Orbit 1 can read at 108 characters per second and up to 130 cards per minute. Designed to read a single line with up to 70 numeric characters, the OCR document reader features an optional head which permits reading of characters and ordinary pencil marks from the same document in the same pass. The unit comes with an automatic feed and two stackers and reads documents ranging in size from four inches to 7.5-inch horizontal, three inch to four inch vertical and from 0.004 inches to 0.0075 inches thick. Basic unit costs $21,800 and includes a document handler, camera, video processing electronics, recognition logic, and document handler control electronics. The unit will be available in the fourth quarter of 1970.

Orbital Systems, Inc., Fellowship and Church Rds., Moorestown, N. J. 08057. (609) 234-1700.

CIRCLE NO. 117

The most expensive word in business is: maybe

It is a virus of uncertainty, a fever of indecision...Maybe.

When business conditions are good the malady lies dormant. But when the economy falters, when competition sharpens, the crippling effect of the situation becomes apparent.

One source of the problem is a failure to communicate—not just in words, but in the motivating information exchanges which are the touchstone of business decision-making. Another is the failure of a manager to extract the total benefit from his company's computer-based information system.

This new course from Kepner-Tregoe communicates a process for resolution:

LOGIX® provides a rational process for bridging the gap between operating managers and the highly technical administrative personnel responsible for Management Information Systems. The manager—across practically every aspect of the corporate spectrum—is the crucial informational interface between problem and solution. Yet he often feels alienated from his computer team. LOGIX gives the manager a cogent appreciation of his alliance with the computing system and a clear process for fulfilling his leadership role.

LOGIX, designed to help business fulfill its prime directive...And *no maybe* about it.

For more information about *LOGIX* and other contemporary courses for today's business, contact: Marketing Department, Kepner-Tregoe, Inc., Princeton, N. J. 08540, Tel: (609) 921-2806

KEPNER TREGOE ® Kepner-Tregoe, Inc., Princeton, New Jersey

INFORMATION RETRIEVAL NUMBER 29

The Repco 120 Printer.

It's fast, quiet, reliable, compatible, compact, only $995* with 30-day delivery.

The REPCO 120 is a low-cost, solid state impactless printer designed to interface with all CRT terminals, minicomputers or other remote data terminals. It operates asynchronously at speeds to 120 characters per second, 80 characters per line, 6 lines per inch vertically. It will handle serial or parallel data of 64 character standard ASCII code. When interfaced with a modem or acoustic coupler, it can be used as a terminal printer over telephone or private wire communications lines. Reliability is assured by integrated circuits, state of the art electronics and only six moving parts. The unit offers an ideal, economical solution for a broad spectrum of video display and minicomputer applications.

*OEM Quantities. Single unit price: $1,500.

REPCO Incorporated, 1940 Lockwood Way, P.O. Box 7065, Orlando, Fla. 32804, telephone (305) 422-2451. A subsidiary of SCOPE Incorporated.

Repco

For demonstration in your area: **EAST:** Bartlett Associates, Inc., Wayne, Penna., (215) 688-7325; White Plains, N.Y., (914) 949-6476; Bethesda, Md., (301) 656-3061 **SOUTHEAST:** Gentry Associates, Inc., Orlando, Fla., (305) 841-7740; Huntsville, Ala., (205) 534-9771; Burlington, N.C., (919) 227-2581; Atlanta, Ga., (404) 233-3816 **MIDWEST:** SEA, Inc., Indianapolis, Ind., (317) 846-2593; Chicago, Ill., (312) 282-6694; Waukesha, Wisc., (414) 547-6637; Minneapolis, Minn., (612) 888-1969 **WEST:** King Engineering Co., Inc., Encino, Calif., (213) 981-0161; Santa Ana, Calif., (714) 546-6883; La Jolla, Calif., (714) 453-7042; Mountain View, Calif., (415) 964-2942; Phoenix, Ariz., (602) 277-5902.

INFORMATION RETRIEVAL NUMBER 15

If your computer has a habit of going "Out to Lunch," it may be starved for power.

OUT TO LUNCH
THURS
TUES
MON

Balance its diet with a GE PowrLok all solid-state uninterruptible power system!

When it comes to electric power, computers need a steady diet. Even minor power fluctuations or disturbances of millisecond duration can cause parity loss, memory loss, systems interrupts and downtime.

Many power disturbances are unavoidable. Natural phenomena such as lightning surges . . . wind whipping tree branches across power lines . . . transient conditions caused by fault clearing . . . other loads being operated on the same feeder — all affect your computer's performance.

To avoid these unappetizing possibilities, fully-utilized real-time centers as well as data processing operations have installed General Electric PowrLok uninterruptible power systems.

A PowrLok system is a buffer between incoming feeder line disturbances and the computer, filtering out voltage and frequency variations. In the event of momentary or sustained loss of normal power, precise, regulated power is supplied continuously.

GE's PowrLok uninterruptible power system will enable you to attain maximum utilization of your computer resources. PowrLok all solid-state systems now protect computer installations throughout the world. Applications range from communication/information systems to instrumentation and process control . . . even intensive care units in hospitals, where complex closed loop monitoring systems help guard lives.

If you can't afford to have your computer go "out to lunch," write GE's "Power Dietician," Power Electronic/Interface Section, Custom Power Equipment Department, P. O. Box 16867, Philadelphia, Pennsylvania 19142. We'll show you how a PowrLok system can balance your computer's power diet, through GE's unmatched experience in the control, protection, and distribution of electric power.

350-01

GENERAL ELECTRIC

INFORMATION RETRIEVAL NUMBER 16

INPUT UNDERGROUND ATTACKED AS ADVERTISING GIMMICK.

Dear Underground:

Okay. I'm on to you. The Input Underground is nothing but an advertising gimmick to call attention to Recognition Equipment's new product line.

Why can't you guys run straight ads like everybody else?

J.C.B.
Des Moines, Iowa

Dear J.C.B.:

The Input Underground contacted Recognition Equipment in regard to your letter. They sent us the following straight ad:

INPUT 80: THE EXPANDABLE READING SYSTEM

Somebody finally developed a comprehensive page reading system that can be customized to the job and expanded to handle a growing workload.

Somebody finally developed INPUT 80.

The new OCR system, designed and developed by Recognition Equipment Incorporated, is three to twelve times faster than the company's previous page reader. It's also more flexible and more versatile.

INPUT 80 can process a wide variety of forms and read a large number of type fonts as well as handprinting, carbon copy and mark sense data.

The system can be used for many applications in many different industries.

In the banking field, INPUT 80 can save considerable time by replacing keypunch and tedious data conversion techniques now used to process installment loans, demand deposits, and savings account transactions.

Insurance companies can cut data processing costs critically by using INPUT 80 to process daily reports, claims and premium billing. Service bureaus serving independent insurance agencies can put INPUT 80 to work on a whole range of insurance records management jobs.

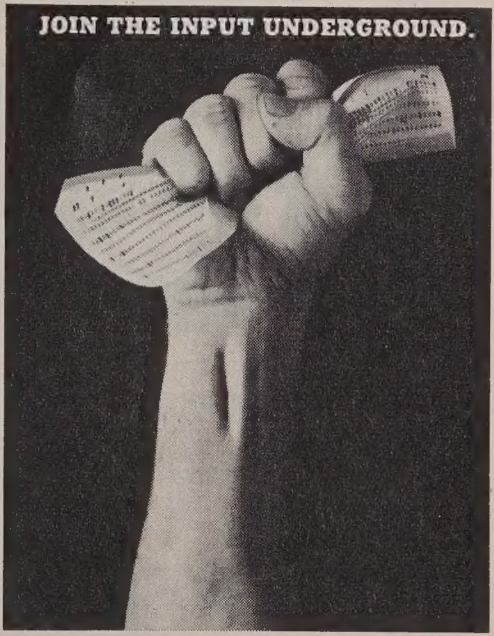
There are also applications for INPUT 80 in state government. The Department of Motor Vehicles can use the system to process drivers license applications. The Human Resources Development Agency can use INPUT 80 to process wage and salary reports, applications for disability and unemployment insurance, and other field-prepared forms. The State Controllers office has two major needs for INPUT 80, payroll and claims.

And, the Board of Education in any major city will find life a lot easier if they process student records with INPUT 80.

For complete information on INPUT 80 or other Recognition Equipment Systems, write to us care of the Input Underground, P.O. Box 5274, Dallas, Texas 75222.

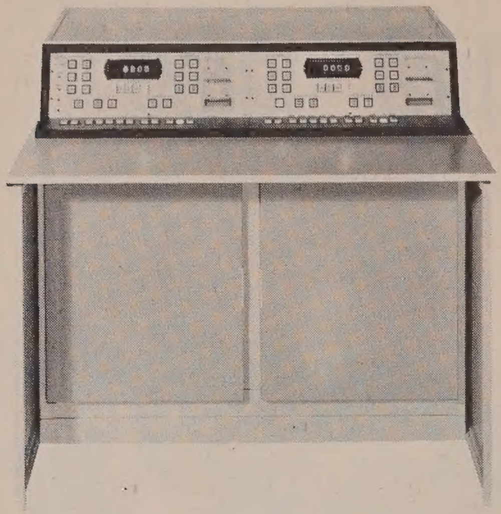
How's that J.C.B.?

It's not too late to join the Input Underground. Just send us your name and address and we'll send you a membership card and button.



PUBLISHED AS A PUBLIC SERVICE BY RECOGNITION EQUIPMENT INCORPORATED.

INFORMATION RETRIEVAL NUMBER 17

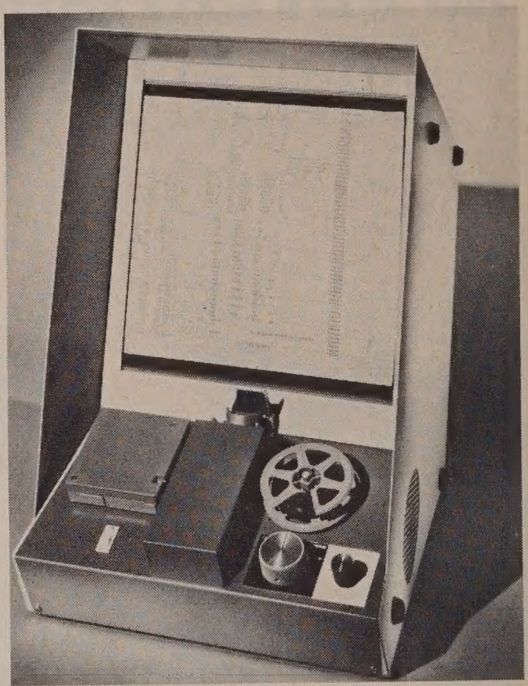


Certifier keeps disk pack data accurate

The Series 1100 disk-pack certifier can distinguish between "soft," or marginal, and "hard," or minimum acceptable errors. Users may adjust the certifier to their own or to federal standards. Optional unit prints a complete disk pack profile. Prices range from $23,000-$30,000; delivery is 90 days.

Interscan, Inc., 5200 Belle Isle,
Oklahoma City, Okla. 73118.
(405) 848-2633.

CIRCLE NO. 220

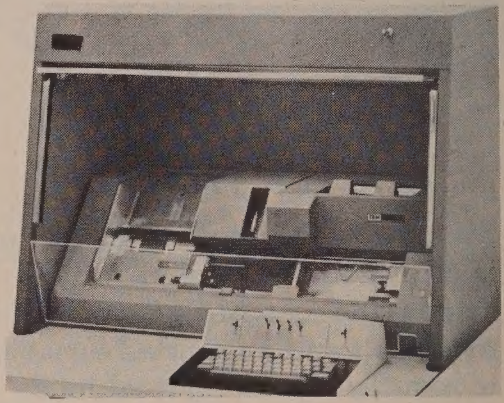


Motorized reader views microfilm at 5 ft/sec.

Capable of handling 16 mm film in either roll or standard film cartridges, the Film-A-Record Reader F-56 has variable forward and reverse speed and can transport 100 feet of film in less than 20 seconds. The unit costs $394.

Remington Rand Office Systems Div.
P. O. Box 171, Marietta, Ohio 45750.
(614) 374-9300.

CIRCLE NO. 221



Acoustical cabinets for edp equipment

More than 40 different models of acoustical cabinets are offered to cut edp equipment noise by as much as 50 per cent. Floor and desk cabinets for IBM key punch machines, communications terminals, magnetic tape typewriters, teletypewriters, Friden Flexowriters and Xerox machines are available. The price for the key punch machine cabinet pictured above is about $200 and delivery is within two weeks.

Edward Ochman Systems, Box 141,
Fairfield, Conn. 06430.
(203) 259-1927.

CIRCLE NO. 222

Your computer is calling!

Not unusual nowadays.

Because the voice of most computers comes from Cognitronics' Speechmaker® audio response systems.

You can hear it in banking, credit checking, inventory and production control, education, voice warning and alarm systems, and many more. Wherever information is needed immediately. And with the lowest-cost terminal possible — a telephone.

Now Cognitronics has a free-standing Multiplexed Audio Response System, too. We call it MARS. It couples our famous voice with mini-computers, completely interfaced.

Listen how voice reply can apply to your business by simply adding a Speechmaker, or with our new MARS system.

Just give us a call.

If a computer answers, don't hang up.

SPEECHMAKER® DIVISION
COGNITRONICS CORPORATION
333 N. BEDFORD ROAD, MT. KISCO, N. Y. 10549
914-666-2941

INFORMATION RETRIEVAL NUMBER 18

Aids management in forecasting, planning

A series of computer programs assist management in forecasting, planning and decision-making. The programs will run on the XDS 940 or any IBM 360 timesharing system. The "Adsim" program ($10,000) is used for risk and venture analysis. It is an interactive language for strategic decision-making and financial planning which can be used to write financial analysis programs in such areas as pricing and new products. The "Adfin" program ($6,000) allows the user to select an activity and develop a cash flow analysis and projections to see the financial effects of various plans on the company. "Adtree" ($5,000) uses decision tree and risk analysis to evaluate the expected impacts of alternative courses of action. "Adlin" is an interactive generalized linear program designed for the easy solution of standard linear programming problems. "Adfit" ($3,000) allows time series analysis of data and permits the study of relationships between two sets of data for predictive purposes. The prices include the object program and training and installation assistance. Delivery is within two months.

Applied Decisions Systems, Inc.,
1300 Soldiers Field Rd.,
Boston, Mass. 02135.
(617) 783-4100.

CIRCLE NO. 223

Cross assembler features speed and convenience

A cross assembler written in Standard Fortran offers speed, convenience, and host machine independence. "Bias" is presently available for the PDP-11 and will assemble code under level G Fortran IV on most systems having at least 100k of core. Bias features include automatic selection and freedom to use forward references in all argument expressions. Price: $1,000. Delivery: one month. Versions for other systems are forthcoming.

Compata, Inc., 18345 Ventura Blvd.,
Tarzana, Calif. 91356.
(213) 881-4000.

CIRCLE NO. 224

Package speeds computer-to-computer data transmission

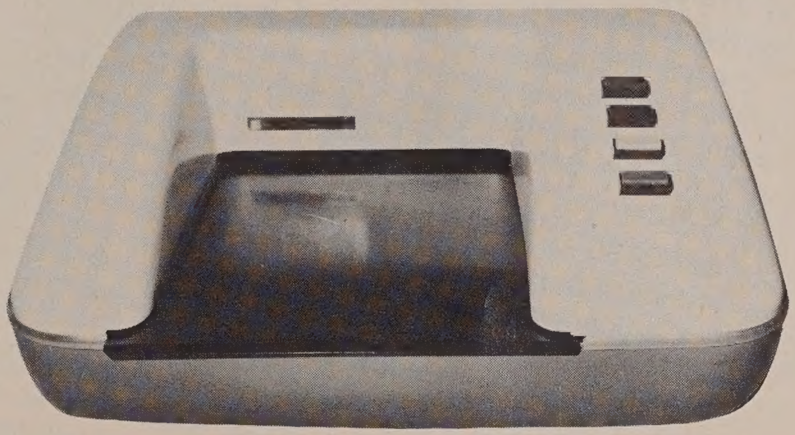
A software package is designed for high speed data transmission between a central and one or more remotely located computers. The Bocs (bisynchronous oriented communications system) package will support leased lines with transmission speeds of 1,200 to 240,000 bits-per-second for transmission of sequential data files. Written in assembler language, Bocs will also help level work loads among several large computer facilities. Bocs is compatible with any multiprogramming environment and will run on any IBM 360/25 or up with at least 32k core. The program also generates daily and monthly reports on transmission time and circuit efficiency. The program including installation is priced at $9,650 and installation is within one month.

G T & E Data Service, 5422 Bay
Center Dr., Tampa, Fla., 33609.
(813) 877-8021.

CIRCLE NO. 225

A NEW
DIMENSION
IN
SOURCE
DATA
AUTOMATION

dataflow optical page reader



The age old problems of manual data preparation such as key punching and verifying have long been accepted as a necessary evil to input man-generated data into an EDP System. The advent of Optical Character Readers (OCR) has opened new horizons in this area; however, the associated prices for OCR equipment has made its availability prohibitive for all but the most affluent of users. The Dataflow Optical Reading System now brings OCR capabilities down to price range compatible with key punching and verifying.

DATATYPE CORPORATION
1050N.W.163rd Drive, Miami, Fla.33169 (305) 625-2489

INFORMATION RETRIEVAL NUMBER 19

Automated service documents programs

Automated documentation services are now available for all Cobol, PL/I, Fortran, BAL, Autocoder/SPS and RPG programs. Documentation includes source listing, data-name, tag-name and paragraph-name cross-references, functional equate tables, tables of modified instructions and format and coding logic diagnostics. All are cross-referenced to a detailed flowchart of the program logic. Accurate documentation in standard format is easily maintained and permits auditing of all program operations. Also, it provides the detail written records you need to treat programming costs as capital expenditures under IRS regulations. Cost is proportionate to program size resulting in a charge of about $15 for an average program. Delivery is within two weeks.
Software Documentation Corp., 3550 West Peterson Ave., Chicago, Ill. 60645. (312) 478-8404.

CIRCLE NO. 130

Analyzer measures computer performance

To provide users with a complete picture of computer system performance, X-RAY measurement system reports on configuration utilization, system software overhead, application program efficiency and data base element activity. Once you know the interaction of these components of computer performance, you can make system improvements empirically through various techniques including equipment configuration balancing, job scheduling and procedure modifications. The analyzer is priced at approximately $50,000.
Computer Learning and Systems Corp., 5530 Wisconsin Ave., Chevy Chase, Md. 20015. (301) 652-9220.

CIRCLE NO. 131

Language translators for any computer group

Able to run on any selected group of computer systems, this service will provide translators which can handle existing common languages such as Fortran, Cobol, and PL/I, or user-specified procedure or problem-oriented languages. This means that the client can develop programs for a current computer system knowing that they will also operate on any future system he may select. The system-independent translators are also useful to those with more than one type of computer system. The service is available nationwide and is priced by contract.
Information Resources, Inc., 331 Alberta Dr., Amherst, N.Y. 14226. (716) 835-3037.

CIRCLE NO. 132

Time-sharing network links major cities

A computer-time-sharing service called the National System allows organizations with offices and plants across the country to share programs and data in a single, central computer. Subscribers to the service can tie into the computer through existing SBC leased telephone lines simply by dialing the nearest network access telephone number. The service has a monthly minimum of $100. Connect time costs $13.80 per hour.
The Service Bureau Corp., 1350 Ave. of the Americas, New York, N. Y. 10019. (212) 262-5000.

CIRCLE NO. 133

CASE

CASE takes the guesswork out of making sound computer system decisions—*accurate* decisions which may involve even the most complex aspects of multiprogramming, real-time or time-sharing systems.

CASE (Computer Aided System Evaluation) is a *proven* simulation system which will predict for any application the interaction of virtually any combination of computer hardware, software, data base and user programs.

Use CASE for—
- **Overall System Design**
- **Configuration Management**
- **Equipment Selection**
- **Installation Audits**

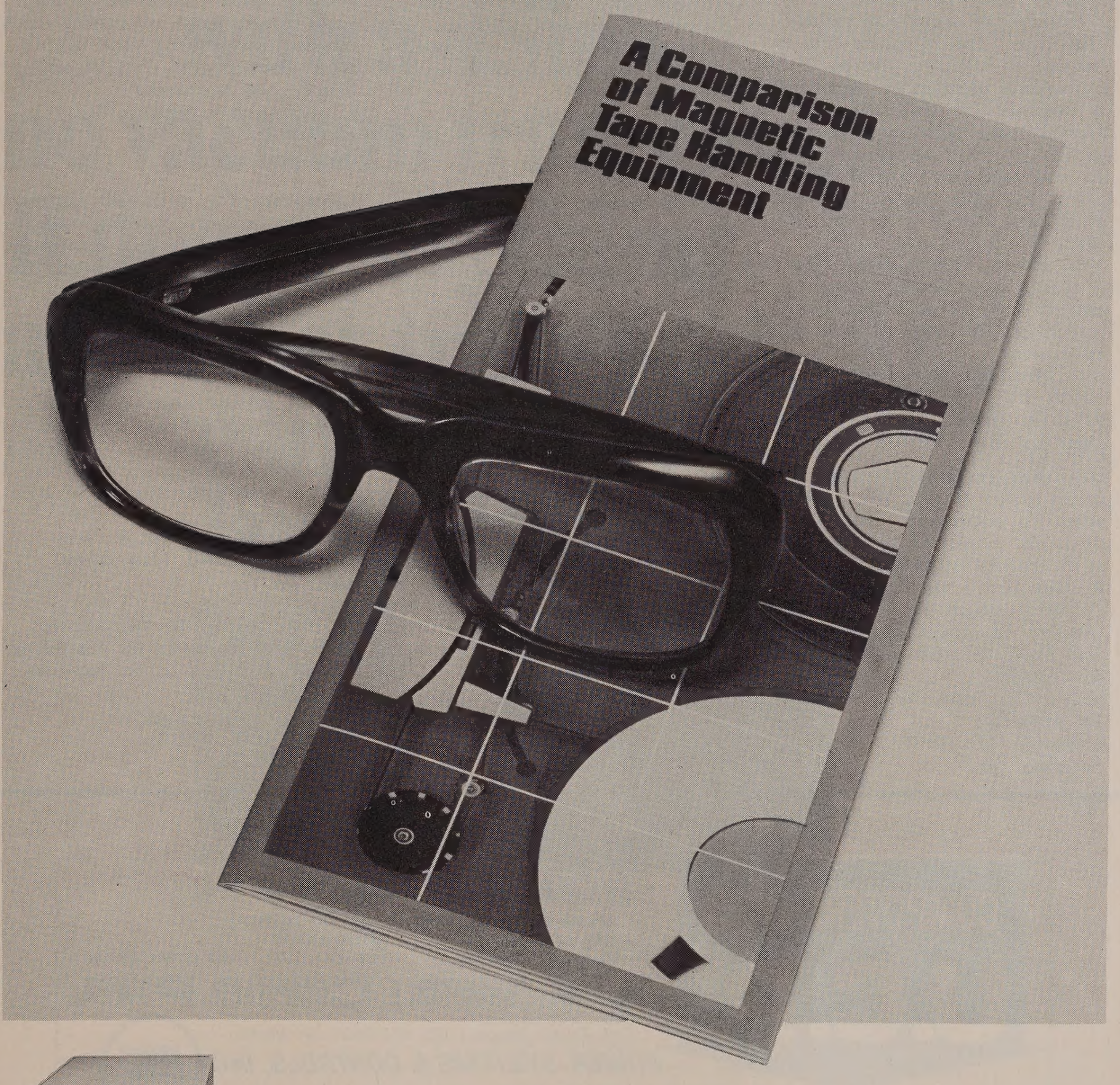
The use of CASE is the least costly way to make system decisions; it is available under lease, license or service plans. We can train you to use it or we will provide highly skilled and experienced analysts to assist you in your simulation efforts. CASE will also interface with our X-RAY™ Computer Performance Measurement System.

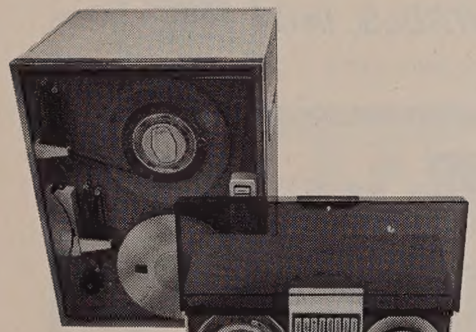
For complete details, contact:

APPLIED SYSTEMS
Division of Computer Learning and Systems Corporation
5530 Wisconsin Avenue, Chevy Chase, Maryland 20015
(301) 652-9220

INFORMATION RETRIEVAL NUMBER 20

Required reading!





This new brochure documents more than 20 important features that have made the Mod 7 and Mod 10 the *modern standard* for low-cost magnetic tape systems. The Mod 7 and 10 give you plug-to-plug compatibility with most controllers, optimum tape interchangeability with IBM systems, high reliability and easy maintenance. Compare, features and value. You'll see why more and more computer, keytape and terminal OEMs are doing their "required reading" and writing on Wang Mod 7 and Mod 10 tape handlers. Call or write for your copy of this new brochure.
It's *Required Reading.*

WANG COMPUTER PRODUCTS, INC.
2000 Stoner Ave., Los Angeles, Calif. 90025 (213) 478-7727

INFORMATION RETRIEVAL NUMBER 21

EDP exam explained

The Certificate in Data Processing (CDP) examination program sponsored by the DPMA is the subject of a 16-mm color sound film entitled "The Key." The 25-minute film is designed to stimulate interest in the examination program by explaining its purposes and objectives. Points covered in the film include the essential facts a person interested in taking the exam needs to know about it, such as eligibility requirements, and where and when it is held. Prints of the film can be obtained from DPMA division vice presidents free of charge for viewing by local DPMA chapters and other interested groups, corporations and other EDP-oriented associations.

Data Processing Management
Assoc., 505 Busse Highway, Park
Ridge, Ill. 60068. (312) 825-8124.

CIRCLE NO. 101

DEC software: Some 700 applications programs for the DEC PDP-10 computer (in addition to standard DEC-supported software) are contained in the PDP-10 Application Software Bulletin. Listing includes software available through the DEC user group (DECUS), or through sale or trade. Also listed are programs under development.

Digital Equipment Corp.
146 Main St.
Maynard, Mass. 01754.

CIRCLE NO. 102

Paperwork: "Reduce the Paper Mountain to Management Size" is a three-ounce (24¢ with wrapper first-class-mail charge), 42 ¾-inch (when extended fully) foldout brochure describing Datagraphix mag-tape/microfilm systems. Well presented, illustrated. Specs on the systems included.

Stromberg Datagraphix, Inc.
Box 2449, San Diego, Calif. 92112

CIRCLE NO. 103

GE-100 banking systems: the latest additions to the General Electric line of bank-information systems are detailed in a four-page brochure. Included are sections on the GE-105 Remote Banking System and the GE-115 Bank Information System. Both systems are designed to process MICR-encoded documents. Specify GEA-9281.

General Electric Information Systems,
Bldg. 6-207, Schenectady, N.Y. 12305.

CIRCLE NO. 104

From the folks who brought you the 707: Boeing's computer services are described in a series of one-page sheets stapled together. Included are conversational terminal services, RJE, computer time sales, computer facilities management and application programming.

Boeing, Computer Services Division
P. O. #3707
Seattle, Washington 98124.

CIRCLE NO. 105

Accessory catalog: 2,000 varied items including fire-protection files for computer tape and punched cards, furniture for the computer room, and magnetic and paper tape are listed in a catalog which is billed as containing "The World's Largest Selection of Data Processing Supplies and Accessories."

Edward Ochman Systems, Box 141
Fairfield, Conn. 06430.

CIRCLE NO. 106

Calculators: The series 100 calculators for scientific, engineering and statistical calculations are described in a four-color, eight-page brochure.

Wang Laboratories, Inc.
836 North Street
Tewksbury, Mass. 01876.

CIRCLE NO. 107

How to get the most out of your computer staff: 20-page report of that title contains information on designing an employee-development plan, and how to train programmers, analysts and managers.

Advanced Management Sciences
Box 56, Lynnfield, Mass. 01940

CIRCLE NO. 108

DC1000: six-page booklet describes Burroughs' processors for controlling peripheral gear at remote locations.

Burroughs Corp.
2nd Ave. at Burroughs,
Detroit, Mich. 48232.

CIRCLE NO. 109

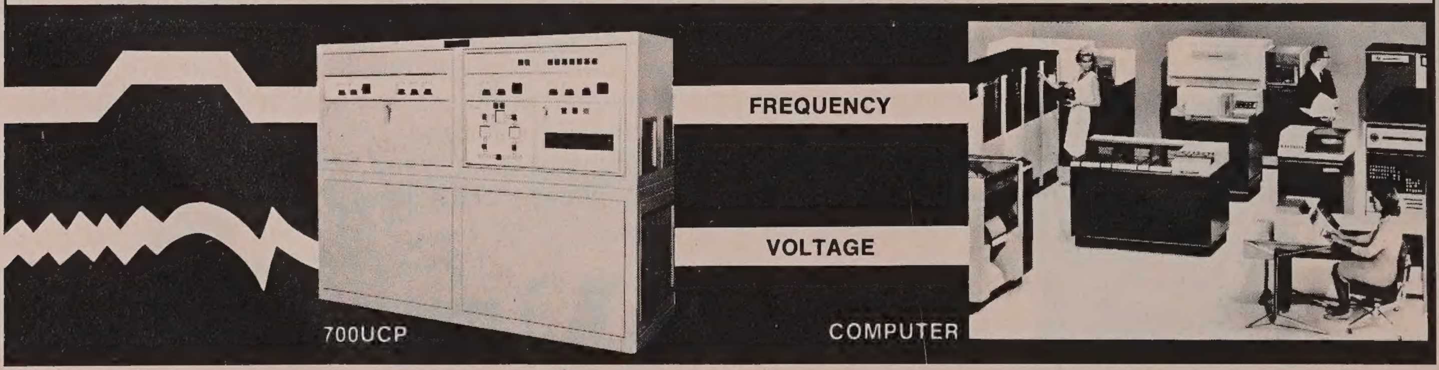
COMPUTERS NEED
U.C.P.*

SYSTEM 700UCP PROVIDES

- "BROWN-OUT" PROTECTION
- VOLTAGE CONTROL
- FREQUENCY CONTROL
- TRANSIENT CONTROL
- LINE ISOLATION
- BRIDGES UTILITY POWER INTERRUPTIONS

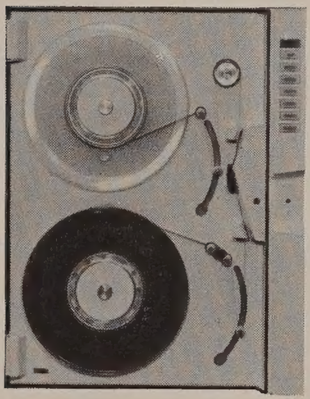
*UNINTERRUPTIBLE COMPUTER POWER

Call Frank Wood (703) 355-2803 OR WRITE
POWER SYSTEMS & CONTROLS, INC
P. O. BOX 1638 • RICHMOND, VIRGINIA 23213

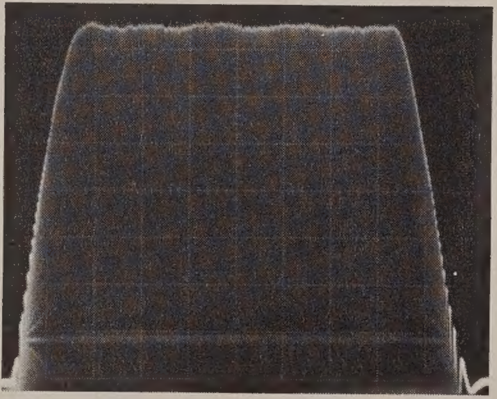


INFORMATION RETRIEVAL NUMBER 22

PEC's just filled the vacuum with a 45ips no vacuum transport. It does everything any other transport can do. For $3150.



Here's the Transport.



Here's the Proof.

Here's a complete new line of low cost, 45ips transports that get up to speed with no velocity transients, no overshoot, and no ringing. And a price tag of $3150 in quantities of 100 for read-after-write. Available in read/write at $2930 in the same quantities, and at similar low prices in 72 new models of read only for off-line applications such as COM. With exclusive PEC data recovery features, this new 45ips, 10½" reel 6000 series comes in 7- and 9-track, 800cpi NRZI. Also available in the new 9-track, 1600cpi phase-encoded USASII and IBM compatible formats. Get the full story on this 45ips breakthrough. Write Peripheral Equipment Corporation, 9600 Irondale Avenue, Chatsworth, California 91311. (213) 882-0030.

PEC

SALES OFFICES: Los Angeles (213) 882-0030 • Orange County (714) 546-4836 • Chicago (312) 696-2460 • Boston (617) 899-6230 • New York (203) 966-3453 • London Reading 582115

INFORMATION RETRIEVAL NUMBER 23

18/30
1800
1130

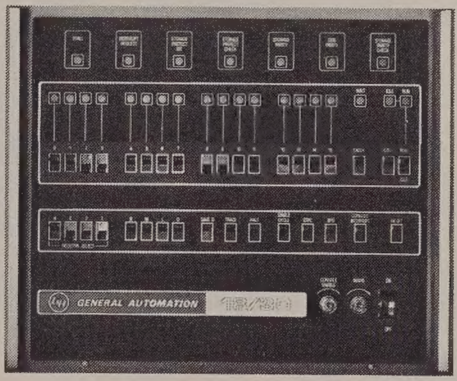
Time to retire the old numbers?

Now . . . The System 18/30 is a super star among automation computer systems. General Automation has added big muscle to the 18/30 in terms of two new software systems — TSS and DMS. Look at this new line up.

TSS is a real time programming system that **replaces** the IBM TSX. It offers program supervision, time keeping, interrupt processing and peripheral control for improved operation of data acquisition and process control applications. TSS is in operation now . . . in key customer locations . . . using software developed for 1800 systems.

DMS . . . replacing the IBM DM2 . . . is a disk-oriented batch processing system using card or key board entry permitting operator monitoring of primary system functions and generating higher throughput levels with greater flexibility and adaptability. Present DM2 1130 packages will run under DMS.

And here's a quick replay of other packages offered. DBOS . . . A user-oriented disk based operating system for batch JOB processing and the compatible RTX software system for real time multi-programming.



And as a bonus . . . all software is available as off the shelf packages.

This new 18/30 Software power makes it "no contest" in system competition — the 18/30 provides a performance/price ratio 20 to 100 times over the old players. If you use the 18/30 to replace your "retiring" system, your software investment is protected. For new installations, the education process with the System 18/30 is minimal.

Now . . . before you invest in any system see our complete line-up.

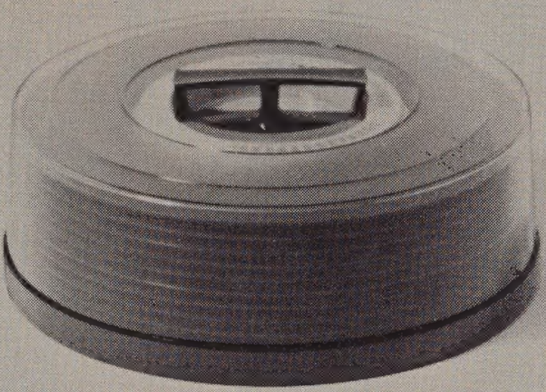
GENERAL AUTOMATION, INC.
1402 East Chestnut Ave., Santa Ana, California 92701
Tel: (714) 835-4804 • TWX — (910) 595-1780

CALIFORNIA — Los Altos, (415) 941-5966, Santa Ana, (714) 835-4804 • **CONNECTICUT** — Stamford, (203) 325-3883 • **GEORGIA** — Atlanta, (404) 261-6203
ILLINOIS — Des Plaines, (California G.A. Corp.) (312) 298-4650 • **MARYLAND** — Silver Spring, (301) 587-7090 • **MICHIGAN** — Detroit, (313) 965-9090
OHIO — Cleveland, (216) 351-2275 • **PENNSYLVANIA** — King of Prussia, (215) 265-6525 • **TEXAS** — Dallas, (214) 358-0271, Houston, (713) 774-8716
BELGIUM — Brussels, 13 78 03 • **ENGLAND** — Esher, 65764 • **GERMANY** — Aachen, 02405-4444, Wiesbaden, 06121-83073

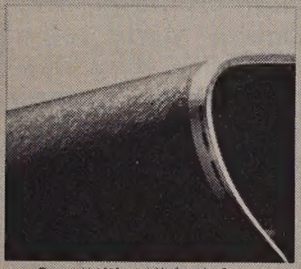
INFORMATION RETRIEVAL NUMBER 30

The salesman who says
all disk packs are alike

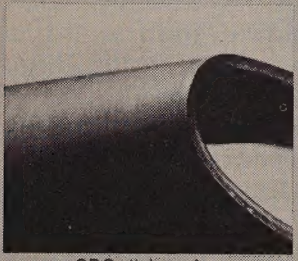
may not want to talk about the differences.



You can't blame him. Unless you want to be selfish. Unless you're concerned about the "typical" problems that go along with typical performance.



Competitive disk surface



CDC disk surface

Unretouched photos of bent disks shows a difference you get with CDC

If you're going to be that one-way, you'd be better off with a CDC man.

He *wants* to talk about problems, because he has a way to solve them. He'll tell you what makes a CDC disk pack different. And makes it the highest performance, most reliable, longest lasting pack available anywhere.

You'll find the discussion brief and interesting. Then he'll tell you the cost. You'll find that surprising.

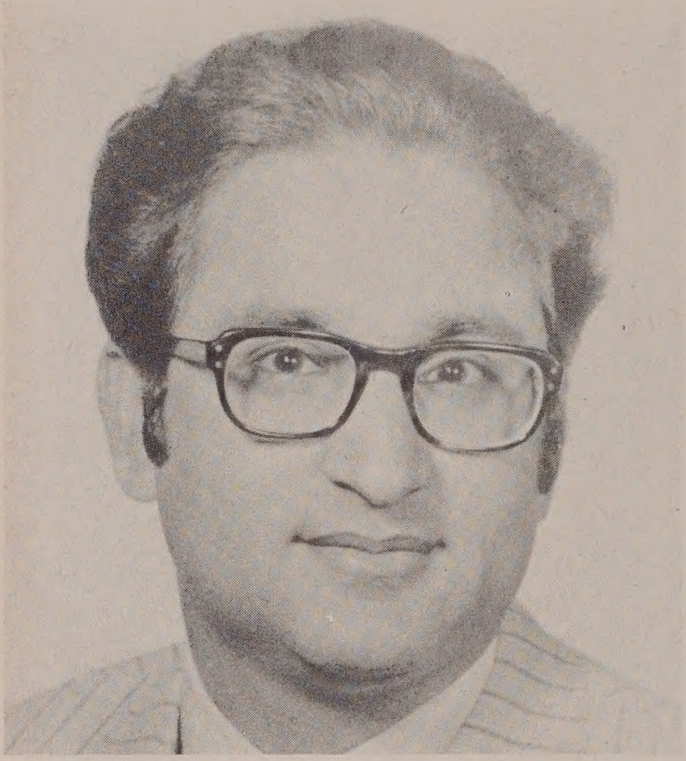
To find out the difference, get our free booklet. Circle the number below, or phone our main office on our "hot line." Call, collect, (612) 884-8195.

CONTROL DATA
CORPORATION

Business Products Group
Dept. 314
Control Data Corporation
P.O. Box 1980
Minneapolis, Minn. 55111

INFORMATION RETRIEVAL NUMBER 5

Self-help education and training can help stem the data processing people crisis



Gopal K. Kapur
Assistant professor
San Jose State College
San Jose, Calif.

The "education gap" in the data processing field seems to be growing rather than diminishing. As computers go more and more places, systems become steadily more complex, and languages and programming methods proliferate, there is a heavy demand for sharp people who are up-to-date with current equipment and methods. What is disturbing is that users, the ones primarily affected, often do little more than complain about the situation.

With some initiative and imagination, data processing people can greatly increase educational opportunities for themselves, the people in their own group, their associates in nearby installations, and other management people in their own company. Here are some specific suggestions.

Today there are lots of seminars, three-day short courses, and so on, where people travel from city to city, pay $375 fees, and get information which may or may not be helpful for their particular learning needs. Why shouldn't data processing specialists organize lots more free seminars on a local level? In most areas, people in the data processing community know each other. Why can't they arrange to get together at someone's house and have three or four people talk about areas in which they have particular knowledge? These people might prepare for three or four months to give two-hour discussions on subjects like "converting from second to third generation programs" or "how to analyze and cut down on costs."

In small groups there would be a chance to get to the core of subjects and problems with valuable practical knowledge being exchanged. There would be no expensive dinners. Maybe coffee, or tea, but no drinks (it would be a working session not a social hour). These local, informal meetings might easily be arranged through the chapters of the ACM, DPMA, AMA, or other societies.

Within a data processing organization, why not have selected individuals prepare presentations for in-house discussion sessions? Aside from teaching other members of the organization about these topics, the people who are giving the instruction will greatly benefit from having to structure their ideas for teaching others who may be neophytes. Enough time should be given so that a good presentation can be prepared, and the manager should check the results before going ahead with group instruction.

As for other managers within the company, the data processing people should occasionally be routing good computer articles from the Harvard Business Review, Computer Decisions, Fortune, or other publications that have non-technical material. Also, why not have short tours of the facility with different data processing people telling about what they do and how the equipment works? But these must be aimed at fundamentals. Once I was giving a talk to a group of top managers and after things became relaxed and we were chatting about the systems, one of them asked how the different machines were connected together! We in data processing forget about things like the false flooring hiding all those cables between parts of the system! So don't start with things like dynamic allocation of core—even computer experts have trouble understanding that!

Gopal K. Kapur

Train 'em in house

the way 500 leading companies do– with VAI

Grow your own EDP specialists! Train anyone, anywhere, any time with *VAI Video Assisted Instruction* — "flight-tested" by major airlines and proved most effective by America's largest corporations. Get unlimited use of top instructors on videotape. Learner-controlled pace lets students work at their own rate and learn faster at less cost.

Courses ready now: Computing System Fundamentals • Introduction to S/360 • Computer Concepts for Management • Fundamentals of Programming • COBOL • RPG • ALC • FORTRAN IV • Advanced FORTRAN IV • Systems Analyst Training Program • Tele-processing Systems Concepts • Computer Operator Training — I/O Devices • DOS-Systems Operator Training • Introduction to OS • OS-JCL • Introduction to Operations Research • Simulation • Linear Programming I (for managers & analysts) • Introduction to Accounting • Introduction to Mathematics. 17 new courses coming soon. Write for complete information.

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CHICAGO, LOS ANGELES, WASHINGTON, D.C., BOSTON, DALLAS, DETROIT, NEW YORK, SAN FRANCISCO. Opening soon in Atlanta.

INFORMATION RETRIEVAL NUMBER 24

Portable data terminals

You can take it with you

All you need to stay in touch with your computer is a telephone, an electric outlet, and the OMNITEC 800 remote terminal. This full conversational terminal weighs less than 25 lbs., complete with TTY-compatible ASCII keyboard, 63-character hard-copy strip printer and integral acoustic telephone coupler. In its rugged carrying case you can take it anywhere; it's okay for airline carry-on. Priced at less than $1,000, the OMNITEC 800 offers a truly economic approach to remote data entry and inquiry/response applications. Off-the-shelf delivery. Write for full details.

OMNITEC
ANOTHER NYTRONICS CORPORATION
903 North Second Street
Phoenix, Arizona 85004
(602) 258-8246

INFORMATION RETRIEVAL NUMBER 25

You are invited to write us about our SERVICE BUREAU for the automatic high-speed encoding of solid plastic DATA CARDS

CARROLL GRAPHICS, INC.
5301 MICHIGAN AVENUE
ROSEMONT, ILLINOIS 60018
DIAL (312) 678-5392

INFORMATION RETRIEVAL NUMBER 26

ADVERTISERS INDEX

Addo-X, Inc. 5
Advanced Systems Incorporated .. 61
American Telephone & Telegraph Company 24, 25
BASF Systems Inc. 3

Carroll Graphics, Inc. 62
Cognitronics Corporation 50
Computer Learning Systems Corporation 52
Computer Transmission Corporation 45
Comress 32A-H
Control Data Corporation 58, 59
Consolidated Computer 40
Courier Terminal Systems, Inc. 43

Datatype Corporation 51
Dick, A. B., Company 26, 27
Digital Equipment Corporation 38

General Automation, Inc. 56, 57
General Electric 14, 15, 48

Hewlett-Packard .... Cover IIA, B C
Honeywell Computer Control Div. .... Cover IV

Infotronics Corporation 39

Kepner-Tregoe, Inc. 46

3M Company 6, 7
Mosler, An American Standard Company 32

Omnitee Corporation 62

Peripheral Equipment Corporation 55
Power Systems & Controls Inc. 54

Recognition Equipment Inc. 49
Repco, Inc. 47

Tempco Computers, Inc. ....Cover III

Vernitron Corporation 33

Wang Laboratories, Inc. 53

A STATEMENT OF PURPOSE

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- *To provide a marketplace for new development in hardware, software and services within both the data processing and information industries.*
- *To give a platform for the presentation of the user's viewpoint.*

PRINTOUT

Will an American Computer Society bring us all together?

You probably know your Congressmen because their activities are, no doubt, well covered by your local paper and tv station. But who speaks up for computer people? I'll bet that a quick survey of your colleagues will produce almost as many answers as you have colleagues. According to this year's SJCC program, the American Federation of Information Processing Societies (AFIPS), which sponsors the JCC's, also "acts as national spokesman for the information processing community in matters dealing with or affected by computing, data processing and related sciences." Well now, that's pretty much all-encompassing isn't it? But when did you last hear of AFIPS making a presentation to a Congressional committee, or answering one of those newspaper horror stories about the computer that became fouled up?

However, despite its claim to represent 100,000 computer professionals, only professional societies can be members of AFIPS. Currently, those members are the Association for Computing machinery (ACM), The Computer Group of the Institute of Electrical and Electronics Engineers (IEEE), Simulation Councils, Inc., (SCI) and the American Society for Information Science (ASIS) plus seven affiliates, presumably lesser bodies than the four big boys. You may be a member of one of the four principal societies of AFIPS. When did you last hear one of them busily representing you? They don't get involved in Congressional affairs (too political), they don't get involved in employer/employee relations (not professional), they don't get involved in presenting a public image for their members (too much like public relations) and so on.

Maybe the time has come for a real society that will look after the interests of people in the computer community without regard for either academic distinctions or so-called professional considerations. How about, say, an American Computer Society open to anyone who wants to join. No academic qualifications needed, no years of experience required. Naturally only those people who are interested in data processing would be likely to join, but others, such as legislators and local and Federal government officials, might also want to join. Such a catholic membership could provide excellent communication between those actively involved with computers and those only marginally involved. The British have had a nationwide society for some years now and their British Computer Society has a membership that is larger than that of the ACM—and that in a country that has only one tenth of the computers installed in the U.S.

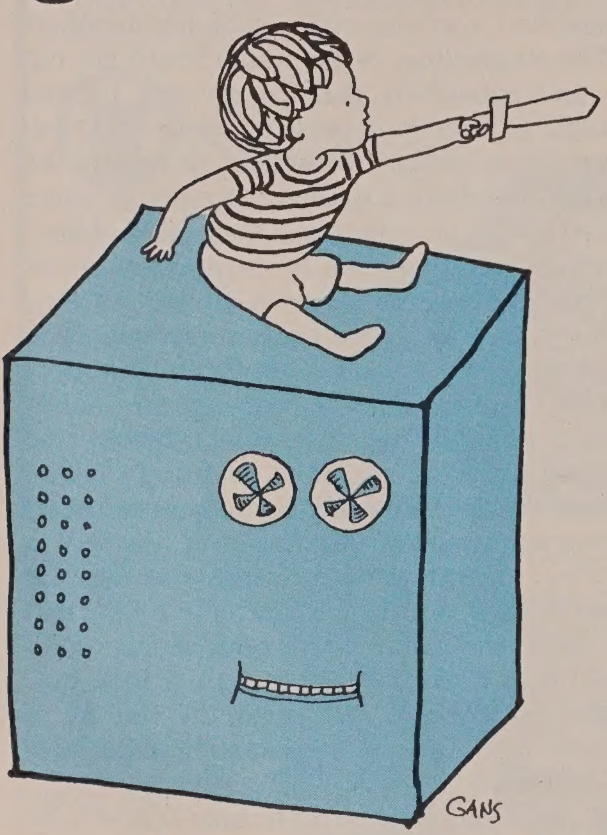
Getting an American Computer Society going will require cash—a lot of it. The only organization that currently is profitable is one without members, and one in which those who provide funds, namely members of its constituent societies and those members of the community who support and attend conferences, have no direct electoral say—AFIPS. The board of directors of AFIPS is composed of representatives elected by the councils of the various members societies and not by the members themselves. The proceedings of the AFIPS board are not made public and conversely there is no way for the computing public to directly impress its views on AFIPS.

Unfortunately it is almost impossible to expect the move toward an American Computer Society to come from within AFIPS. At no time has AFIPS taken definitive steps towards amalgamating its component societies. In fact the factionalism appears to be growing. The Computer Group of the IEEE has recently been considering establishing itself as a professional society outside the IEEE. Although this is probably not looked upon with much favor by the IEEE establishment, the Computer Group expects to become "a society within IEEE" whatever that is. Recently, an Association of Computer Programmers and Analysts was formed in New York City. The new association has already started its own branch on the internecine warfare that characterizes many of the related professional computer societies. Isn't it about time we took a look outside these petty differences and began to aim for a society that will take care of representing the entire computer community?

One way of persuading legislators to take action is by bombarding them with letters, telegrams, personal contacts, etc., that encourage a particular line of action. I'd like to suggest that we begin to approach people in the computing community who might be active in forming a new American Computer Society either by devoting time or by sponsoring loans to get the new society off the ground. My list would include: Sam Wyly, UCC; Dr. Herbert Grosch, NBS; Robert Bemer, GE; Max Palevsky, XDS; Charles P. Lecht, Advanced Computer Techniques; Dr. E. S. Savas, City of New York; Daniel McCracken; Paul Williams, Boothe Computer Corp.; Phillipe Yaconnelli, Katun Corp.; Dick Brandon, Brandon Applied Systems; Dr. Louis Robinson, IBM; Martin Goetz, Applied Data Research.

By the time you read this Perspective, all the people on my list will have received a copy of this column and a personal letter encouraging them to action. How about forming your own list and writing for yourself? COMPUTER DECISIONS will gladly provide reprints of this Perspective, if needed, and forward letters. *J.N.B.*

How will the computer be used to help design the coming generation?



There is a unique aspect to this time in human history. The "tools" that bind our civilization into a unified system are for the first time beginning to change in the period of a decade or less. Changes will be even more rapid in the future. This is having serious effects on the ability of our social institutions to adapt to the changes.

By "tools" we refer to something similar to Marshall McLuhan's "media." For example, in Roman days, roads were a significant development for human interchange. Money for trading, clocks and watches for making appointments, and the printing press were all "tools" with profound effects. The succession of vehicle transportation (chariots, carriages, sailing ships, steam engines for ships and railroads, automobiles, airplanes) and communications media (drum, telegraph, radio and television) have all brought great changes to civilization.

As time passed, each of these tools moved from idea to widespread use in a shorter period. In past eras there was time for social structures to adjust so that the new tools could be integrated into their fabric. Today the time is much shorter, and tomorrow, it will be even less.

A central problem is that people are not used to changing their habits, the ways they conduct their daily lives, their loyalties and interests, in a short period of time.

For example, how well is the government adjusting to such things as controlling data banks, coping with environmental pollution, or stemming urban decay? How well is labor adapting to automation and management to the computer?

The answer to all these is the same . . . poorly.

Although the tools are changing more and more quickly, we are not significantly changing the way in which we teach our children to adjust to these ever-more rapid changes. Much unrest among young people all over the world today is undoubtedly because of their awareness of the flaws in our current social structures coupled with the realization that they are not being properly prepared to make the necessary adjustments.

We have hardly begun to deal with the computer, today's chief offender in disrupting society. Yet its potential for the future is so far only dimly perceived.

One hopeful prospect for the computer, one that has hardly been touched, is for education. Properly used it might help young people to become adept at exploratory, creative activity. This is the kind of learning that pre-school children do naturally, but that is trained out of them by conventional education with its strictures against making mistakes, "silly" ideas, or non-curricular activity. Such creative methods may be the only way for the next generation to cope with rapid changes.

So far the concentration of large computer manufacturers, and of government funding, has been on computer-aided instruction based on the methods of conventional education. Today there are a few individuals and groups exploring the possibilities of tying the computer into new modes of education. We urge much greater support for this work, preferably outside large manufacturing firms whose major concern is sales.

Through the medium of education we "design" the next generation for a world to come. It now seems clear that if tomorrow's adults are not highly adaptable, creative and adjustable people, they're not going to make it! Why do we waste so much money and effort in the wrong directions? *R.C.H.*

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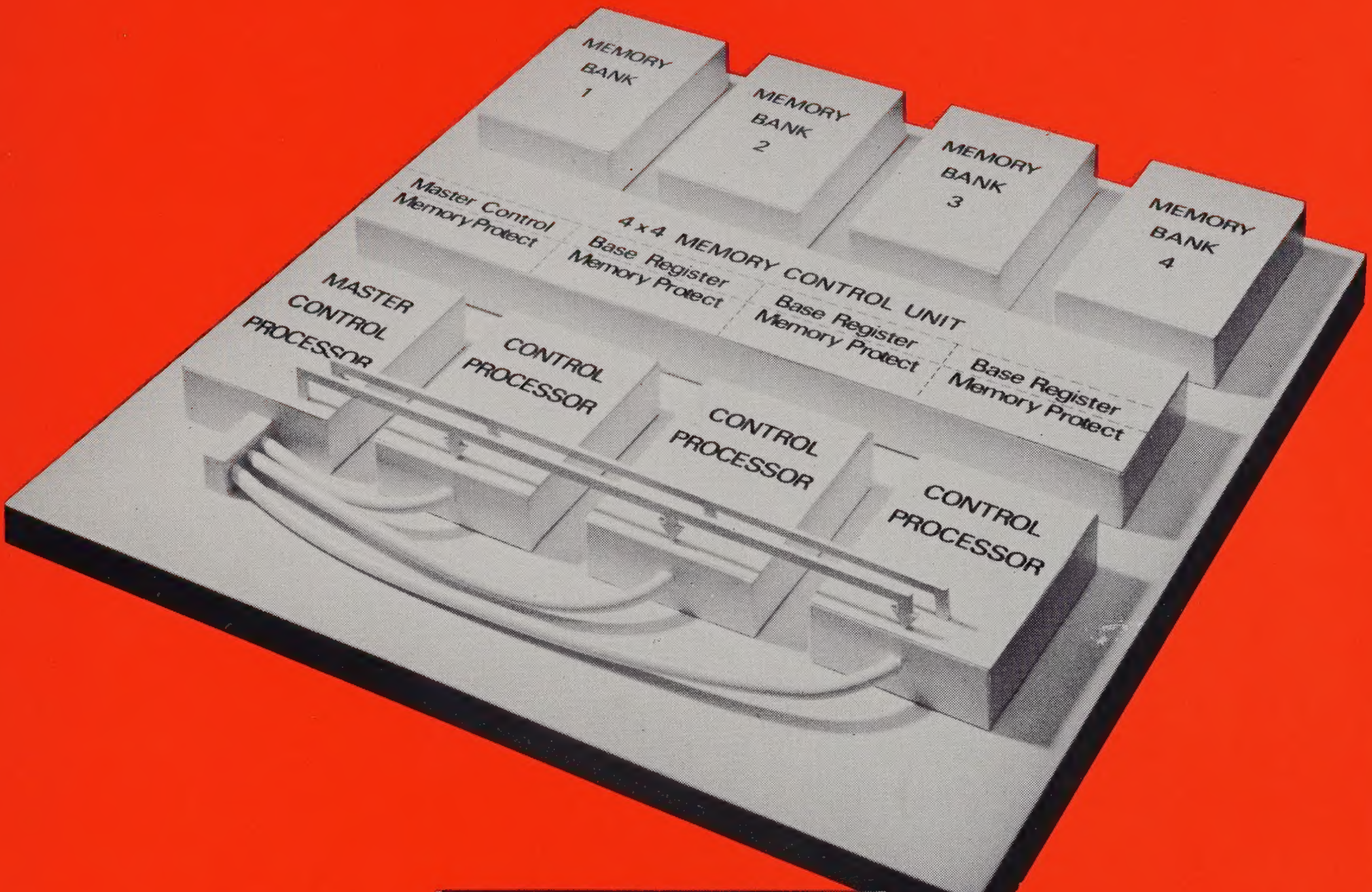
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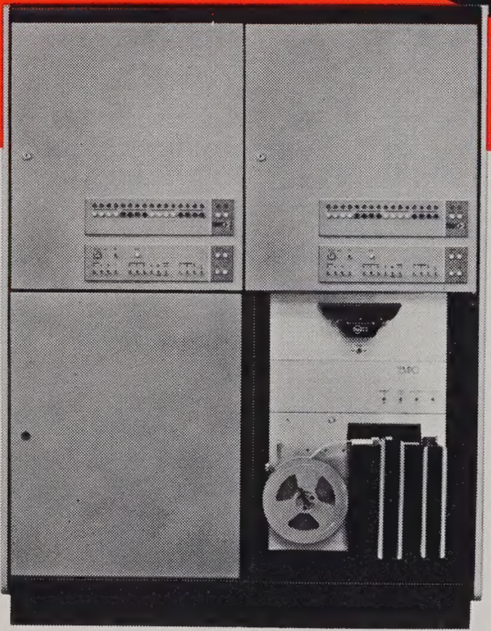

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